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User's Guide for the Submarine Communications Assessment Tool (SCAT) of the Coverage Prediction Improvement Program (CPIP) Software Version 4.0

T. A. Hepner

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Naval Command, Control and
Ocean Surveillance Center
RDT&E Division

San Diego, CA
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**NAVAL COMMAND, CONTROL AND
OCEAN SURVEILLANCE CENTER
RDT&E DIVISION
San Diego, California 92152-5001**

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SECTION 1

SCOPE

1.1 IDENTIFICATION

This User's Guide (UG) provides instructions sufficient to execute the Submarine Communications Assessment Tool (SCAT) Software Version (SV) 4.0 of the Coverage Prediction Improvement Program (CPIP). The SCAT is a single Computer Software Configuration Item (CSCI).

1.2 SYSTEM OVERVIEW

The SCAT can be used to determine the signal-to-noise ratio (SNR) or the minimum power required to provide coverage from one or more Very Low Frequency/Low Frequency (VLF/LF) transmitters to one or more user-selected operating areas. The SCAT can also be used to view coverage charts. The SCAT generates the following types of analysis:

- A percentage of full-power histogram, which displays the percentage of full power required for the selected transmitter(s) to fully cover the selected operating area(s).
- A signal-to-noise ratio (SNR) histogram, which depicts VLF/LF transmitter(s) signal levels, in decibels (dB), for the selected operating area(s).
- A composite maximum or minimum SNR histogram, which shows the level of the transmitter with the highest or lowest SNR ratio, in decibels (dB), for the selected operating area(s) during each 30-minute time interval.
- A minimum-power histogram, which shows the minimum power level, in kilowatts (kW), required by the selected transmitter(s) to cover the selected operating area(s).
- A time availability chart, which shows the periods of copy/no copy for the selected transmitter/operating area pairs.
- Coverage charts that show the areas in which signal copy is possible for the selected transmitters.

The SCAT is an OS/2 Presentation Manager (PM) program. It requires OS/2 Version 2.0 or higher. The SCAT provides a full Graphical User Interface (GUI) through which all user/program interaction occurs. Context-sensitive, online help is always available.

The SCAT can only be used with pre-generated transmitter data sets. For each transmitter included in the SCAT distribution, a series of 96 data files are generated for each of the four seasons (December-February, March-May, June-August, September-November). These data files are used by the SCAT program to determine the required power or SNRs for the selected operating areas. The SCAT program can not generate these data files.

A passing familiarity with OS/2 (or a similar windowing environment) is assumed in this document. It is suggested that the user consult the OS/2 user's manual (see reference 2.a) and online help for assistance in using the OS/2 operating system.

1.3 DOCUMENT OVERVIEW

This UG provides the steps for executing the software, the expected output, and the measures to be taken if error messages appear. The information provided in this UG is directed to the functional user of the SCAT.

- Section 1, Scope, identifies the program to which this UG applies and provides a brief description of this UG.
- Section 2, Referenced Documents, provides a list of the specific version of all documents referenced in this UG.
- Section 3, Prerequisites, identifies the minimum hardware and software requirements for operating the SCAT and describes the installation of the SCAT program.
- Section 4, Basic Menu Operations, presents the information and instructions necessary for user interaction with the SCAT in order to carry out software operations.
- Section 5, Creating a Scenario for Analysis, describes the step-by-step procedures and identifies options available to the user.
- Section 6, Running a Scenario, describes the available analysis types and how they are performed.
- Section 7, Modifying a Transmitter's Characteristics, provides instructions for modifying transmitter characteristics that the user may modify.
- Section 8, Examples, provides step-by-step examples of the SCAT capabilities.
- Section 9, User Preferences, provides instructions on using the preferences notebook.
- Section 10, Notes, identifies points of contact for technical assistance, provides the distribution statement, and describes known limitations. This section also presents an alphabetical listing of all acronyms, abbreviations, and their meanings as used in this document.

SECTION 2

REFERENCED DOCUMENTS

The following documents have been used in the preparation of this guide or are referenced in this guide:

- a. OS/2 Version 2.0 *Installation Guide*, IBM, May 1993.
- b. CPI/FPM-SDP-01-U-R0C0, "Software Development Plan for the Fixed VLF/LF Power Management Capability (FPMC) of the Coverage Prediction Improvement Program (CPIP)," 10 November 1993.
- c. CPI/SCA-VDD-01-U-R2C0, "Version Description Document for the Submarine Communications Assessment Tool (SCAT) of the Coverage Prediction Improvement Program (CPIP) Software Version (SV) 4.0", 30 November 1996.
- d. CPI/FDB-VDD-01-U-R2C0, "Version Description Document for the Fixed VLF/LF Data Base (FDB) of the Coverage Prediction Improvement Program (CPIP) Software Version (SV) 3.0," 30 November 1996.

SECTION 3

PREREQUISITES

3.1 HARDWARE/SOFTWARE REQUIREMENTS

The SCAT program has the following minimum requirements:

Hardware:

- 80486/DX or higher Intel (or compatible) Central Processing Unit (CPU) (A Pentium™ processor is strongly recommended).
- 8 megabytes (MB) of Random Access Memory (RAM) (32 MB is recommended).
- Super VGA Graphics Array (SVGA) color graphics at 640x480 resolution (1024x768 or 800x600 recommended) using at least 256 colors.
- Any OS/2 compatible graphics printer (black and white or color) for hard copy.
- 2 MB of free hard drive space for the SCAT program.
- 20 MB of hard drive space for each VLF/LF transmitter included in the database.

Software:

- OS/2 Version 2.0 or higher (Version 3.0 recommended).
- SCAT SV 4.0 program.
- FVLF database SV 2.0 (described in reference 2.d).

3.2 INSTALLATION

To install the SCAT program, use the following procedures:

1. Open an OS/2 command window.
2. Insert the disk labeled "SCAT program disk 1" into the floppy disk drive (either a: or b:). The following instructions assume that drive "a:" is used. If drive b: is used, substitute "b:" for all occurrences of "a:".
3. Type C: to go to drive C:.
4. Type cd \ to go to the root of drive C:.
5. Type mkdir SCAT to create a SCAT directory, if the directory does not exist..
6. Type cd \SCAT to change the current directory to the SCAT directory.
7. Type copy a:.* to copy the SCAT program files from the floppy drive into the SCAT directory.
8. Remove the disk from the floppy driver.
9. Type UNZIP SCAT_V40.ZIP to uncompress the data files into the SCAT directory.
10. Insert the disk labeled "SCAT fixed data disk 1" into the floppy disk drive (either a: or b:).
11. Type C: to go to the drive C:.
12. Type cd \ to go to the root of the drive.
13. Type mkdir LWPC_DAT
14. Type cd \LWPC_DAT
15. Type copy a:.* to copy all files from the diskette onto the hard drive.
16. Type unzip lwpc_dat.zip to unzip the compressed files.

This concludes installation of the SCAT program. Installation of the Fixed VLF/LF (FVLF) database (FDB) is not discussed in this document. Separate instructions for installation of the database are included with the FDB Version Description Document (VDD) (reference 2.d).

SECTION 4

BASIC MENU OPERATIONS

The SCAT program uses a graphical user interface (GUI) to obtain inputs from the user and display results in a graphical form. Unless otherwise indicated, all mouse operations require a single click of the left mouse button. To access the menus, the mouse is fully supported, as are keyboard shortcuts for the more experienced OS/2 user. Keyboard shortcuts are the underlined letter for each menu item, as shown in the figures and depicted in the textual reference(s) to that menu item. To use the keyboard shortcuts, press the Alt key while pressing the underlined letter.

To begin a SCAT session, either type SCAT at an OS/2 command line prompt or select the SCAT icon from the OS/2 desktop. The program begins by presenting the user with the main menu selection screen, illustrated in figure 1. The items presented on the main menu selection screen are described below.

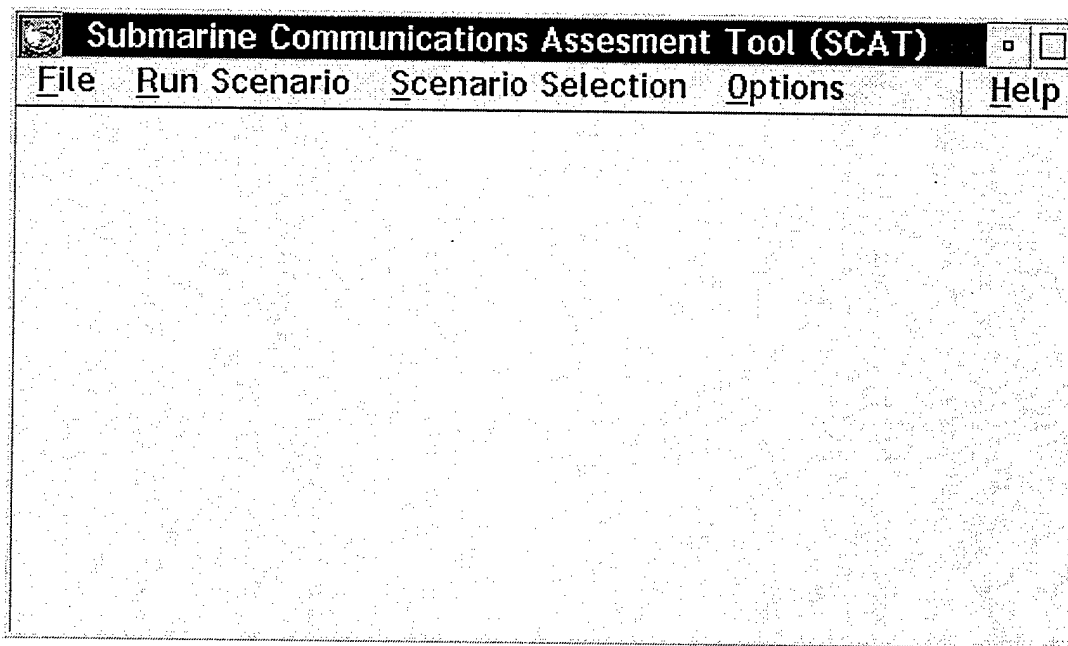


Figure 1. SCAT Main Menu Selection Screen.

4.1 FILE

The File menu item is used to select file-related items. This menu contains three submenu items, as illustrated in figure 2 and described below.

<u>F</u> ile	<u>R</u> un Scenario	<u>S</u> cenario Selection
<u>M</u> odify Tx Data...		
<u>P</u> references...		
<u>D</u> isplay Map		
<u>E</u> xit		F3

Figure 2. File Menu Screen.

4.1.1 Modify Tx Data

The Modify Tx Data... submenu item is used to modify a transmitter's predefined characteristics (i.e., its maximum radiated power in kW, and its mode of transmission). Instructions for modifying these characteristics are provided in section 7.

4.1.2 Preferences

The Preferences... submenu item is used to select and modify the program's preferences (such as the default map type, season, transmitter, etc.). The preferences notebook is explained in section 9.

4.1.3 Display Map

The Display Map submenu item is used to display the selected map. This allows the operator to generate a hard copy of the map that is used for the analysis, without any coverage chart contours being generated on the map.

4.1.4 Exit

The Exit submenu item is used to exit the program. When this menu item is selected, the SCAT program exits immediately. The F3 function key may also be used to exit the program.

4.2 RUN SCENARIO

The Run Scenario menu item is used to perform a specific type of analysis using inputs from the Scenario Selection menu items. This menu contains eight submenus, as illustrated in figure 3 and described below.

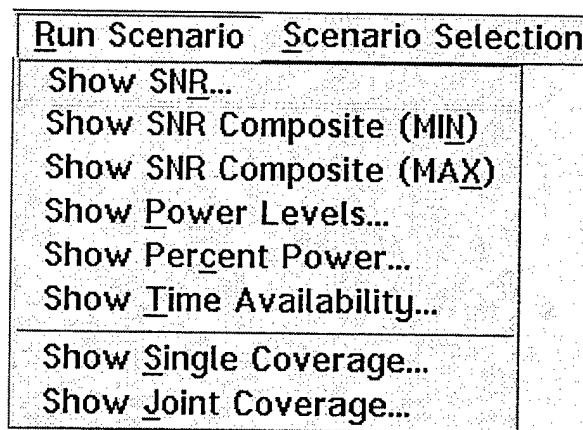


Figure 3. Run Scenario Menu Screen.

4.2.1 Show SNR

The Show SNR... submenu item is used to display a histogram of the minimum SNR for each of the selected transmitter(s) to the combined selected operating area(s).

4.2.2 Show SNR Composite (MIN)

The Show SNR Composite (MIN)... submenu item is used to display a single coverage chart that shows the transmitter that provides the least amount of coverage for the selected operating areas during each 30 minute time period.

4.2.3 Show SNR Composite (MAX)

The Show SNR Composite (MAX)... submenu item is used to display a single coverage chart that shows the transmitter that provides the greatest amount of coverage for the selected operating areas during each 30-minute time period.

4.2.4 Show Power Levels

The Show Power Levels... submenu item is used to display a histogram of the radiated power (in kW) required for each of the selected transmitter(s) to fully cover the combined selected operating area(s).

4.2.5 Show Percent of Power

The Show Percent Power... submenu item is used to display a histogram of the percentage of full power of the selected transmitter(s) that is required to fully cover the combined selected operating area(s).

4.2.6 Show Time Availability

The Show Time Availability... submenu item is used to display a series of charts that illustrate periods of copy/no copy for the selected transmitter(s) and operating area pairs.

4.2.7 Show Single Coverage

The Show Single Coverage... menu item is used to display coverage charts at a selected time resolution for a single transmitter and map area.

4.2.8 Show Joint Coverage

The Show Joint Coverage... menu item is used to display joint coverage charts at a selected time resolution for the selected transmitters (two to four) and map area.

4.3 SCENARIO SELECTION

The Scenario Selection menu item is used to define a scenario for analysis. As illustrated in figure 4 and described below, Scenario Selection contains five submenus that allow for selection of the following parameters:

- One or more transmitters and one or more modes of transmission for each of the selected transmitters.
- One or more receiver/operating areas, using either a rectangular or arctic map.
- An availability level.
- The season and time interval to use for the analysis.
- A power schedule to use with a transmitter.

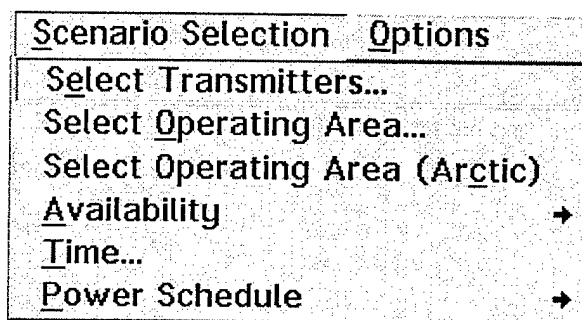


Figure 4. Scenario Selection Menu Screen.

4.3.1 Select Transmitters

The Select Transmitters... submenu item is used to select one or more transmitters and one or more modes of transmission for each of the selected transmitters. At least one transmitter must be selected to run an analysis. Details on selecting a transmitter are presented in section 5.1.

4.3.2 Select Operating Area

The Select Operating Area... submenu item is used to select one or more receiver/operating areas. At least one operating area must be selected to run an analysis. Details on selecting an operating area are presented in section 5.2.

4.3.3 Select Arctic Operating Area

The Select Operating Area (Arctic)... submenu item is used to select one or more receiver/operating areas. Details on selecting an operating area using an arctic map are presented in section 5.3.

4.3.4 Availability

The Availability submenu item is used to select an availability (confidence) level. An availability level must be selected to run an analysis; the default level is 90%. Details on selecting an availability level are presented in section 5.4.

4.3.5 Time

The Time... submenu item is used to select a season and a time period for the analysis. A season and time period must be selected to run an analysis; the defaults are Sep/Oct/Nov and 24 hours. Details on selecting a time period are presented in section 5.5.

4.3.6 Power Schedule

The Power Schedule submenu is used to define or select a power schedule to be used with a transmitter while performing a communications assessment. Details on defining and selecting a power schedule are presented in section 5.6.

4.4 OPTIONS

The Options menu item is used to define parameters for the Show Coverage scenario. As illustrated in figure 5 and described below, Options contains five submenus that allow for selection of the following parameters:

- The type of coverage map to be displayed.
- The type of projection to be used in the coverage display.
- The time resolution for update of the coverage display.
- A user-specified label for the plot.
- The display of the day/night terminator.

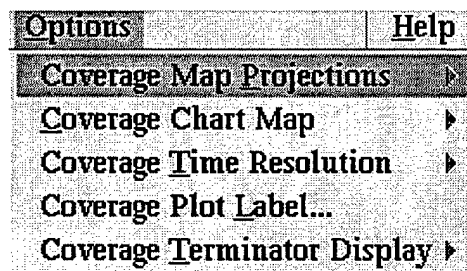


Figure 5. Options Menu Screen.

4.4.1 Coverage Map Projection

The Coverage Map Projection... submenu item is used to select the type of projection to be used in the Show Coverage analysis. The available projection types are rectangular (default), gnomonic, azimuthal equidistant, and orthographic.

4.4.2 Coverage Chart Map

The Coverage Chart Map... submenu item is used to select the type of map to be displayed. A map selection must be made to run the Show Coverage analysis. The available map types are no map, land map (default), coastal outline map, and ground conductivity map.

4.4.3 Coverage Time Resolution

The Coverage Time Resolution... submenu item is used to select the time interval to be used in the Show Coverage analysis. The available time intervals are 30 minutes, 1, 2, 3, 4, or 6 hours.

4.4.4 Coverage Plot Label

The Coverage Plot Label... submenu item is used to assign a label to a plot for the Coverage analysis. The user may enter an alphanumeric character string (maximum 80 characters) from the keyboard to label the plot. This label appears at the bottom of each coverage chart printed by the program.

4.4.5 Coverage Terminator Display

The Coverage Terminator Display... submenu item is used to select the type of terminator display to be used in the coverage analysis. The available selections are: no terminator is to be displayed; a set of lines showing the terminator; an overlay showing the nighttime portion of the selected map display; or a combination of lines and nighttime overlay is displayed.

4.5 HELP

The Help menu item is used to obtain online, context-sensitive help. For more information on help, either select the Help menu item, or refer to reference 2.a.

SECTION 5

CREATING A SCENARIO FOR ANALYSIS

This section describes the options available to the user when creating a scenario for a power management/coverage assessment analysis.

5.1 SELECTING VLF/LF TRANSMITTERS

To select a set of VLF/LF transmitters for analysis, select Scenario Selection -> Select Transmitters. This will start the Select Transmitters dialog, illustrated in figure 6. This dialog permits the selection of from one to four transmitters. To select a transmitter, position the mouse pointer over the desired transmitter's name and press the left mouse button. The selected transmitter will be highlighted, and will remain highlighted until it is deselected.

To deselect a highlighted transmitter, position the mouse pointer over the highlighted transmitter and press the left mouse button. The highlighting will be removed and the transmitter will no longer be selected. Once all the desired transmitters have been selected, press the **Ok** button to save the selections and dismiss the dialog. To dismiss the dialog without saving the selections, press the **Cancel** button. For on-line help with selecting a transmitter, press the **Help** button.

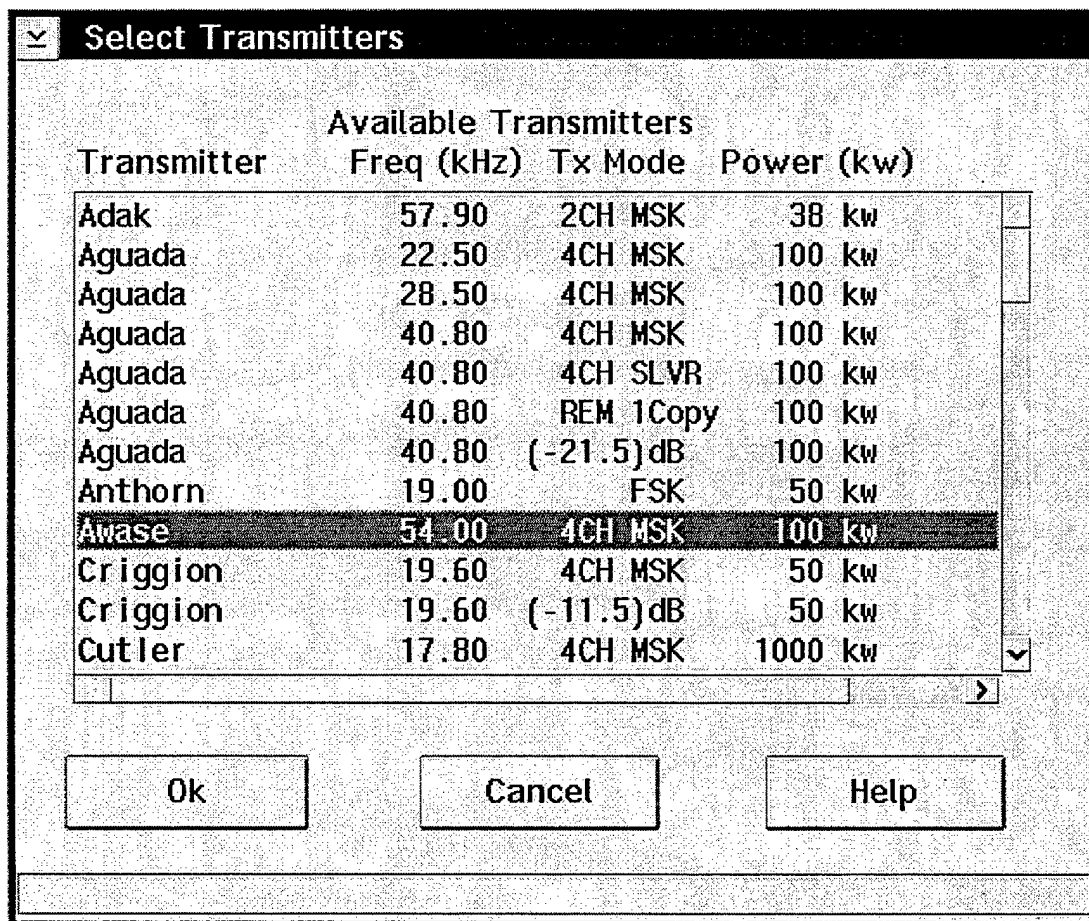


Figure 6. Select Transmitters Dialog.

5.2 SELECTING AN OPERATING AREA

To begin selection of an operating area, select Scenario Selection -> Select Operating Area. This will start the Select Receiver/Op-Areas dialog, illustrated in figure 7. This dialog provides for the selection of one to ten receiver/operating areas. The SCAT uses only water areas in its analysis, thus signal and noise values over land masses enclosed by selected operating areas are not used when performing calculations.

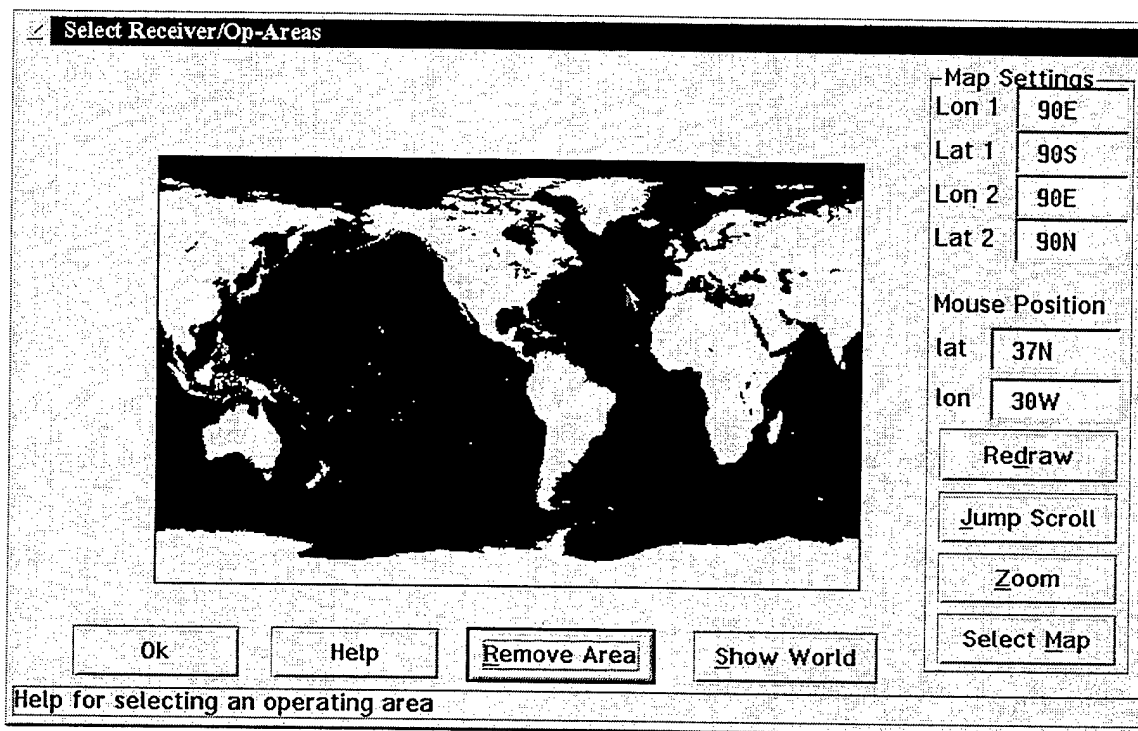


Figure 7. Select Receiver/Op-Areas Dialog.

The mouse is used to select rectangular operating areas. Position the mouse pointer at one corner of the desired operating area on the map; press and hold down the left mouse button while moving the mouse pointer to the opposite corner. While the mouse button is being held down, an outline box will surround the selected area; when the button is released, the operating area will be represented by a shaded rectangle. Up to ten areas may be selected by repeating the above procedure. An example of a selected operating area is illustrated in figure 8.

While the mouse pointer is over the displayed map, its current longitude and latitude are displayed to the right of the map (in the area labeled Mouse Position). The coordinates of the currently displayed map are also displayed to the right of the map (in the area labeled Map Settings). (A list of selected areas may be viewed in the Remove a Selected Operating Area dialog, described in section 5.2.4). Once the desired operating areas have been selected, select the Ok button to save the selections and dismiss the dialog. For on-line help with selecting an area, select the Help button.

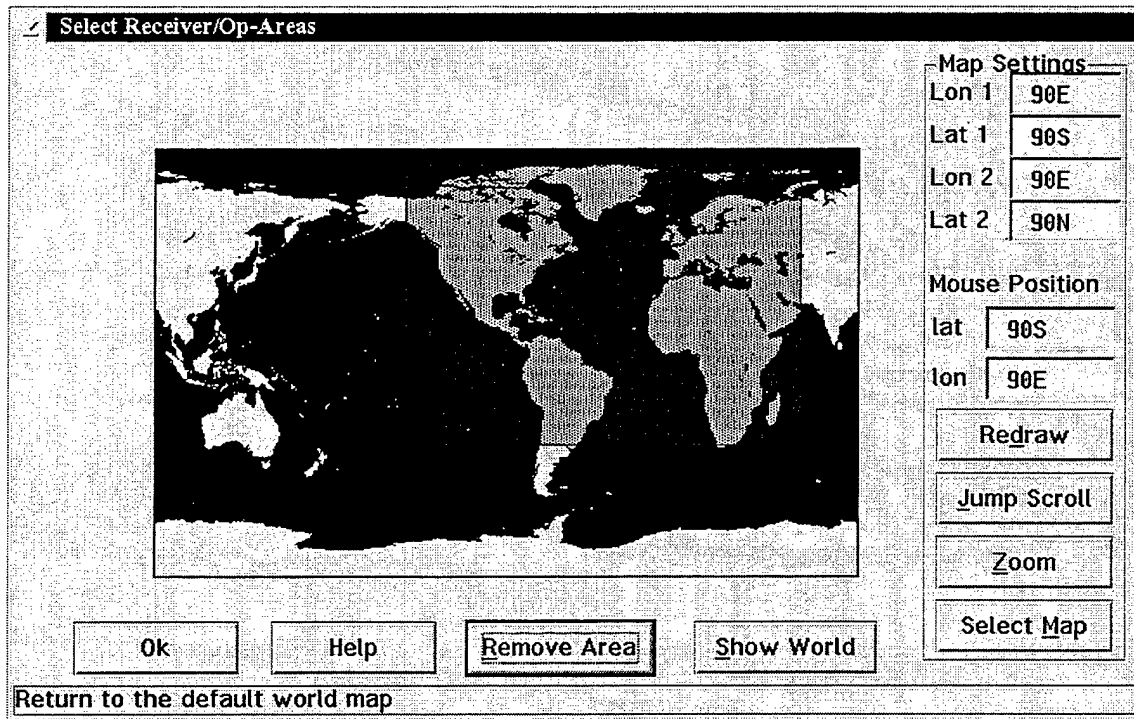


Figure 8. Example of a Selected Operating Area.

While the default world map is useful for most area selections, there may be times when a finer resolution map of a specific region is desired. The SCAT provides several methods of selecting a new map display. The user may zoom in on the most recently selected operating area, perform a jump scroll of the currently displayed map, or select a new map from a list of predefined maps. At any time while selecting an operating area, the default world map may be selected by selecting the Show World button. The following sub-sections describe each of the available methods of changing the default map.

5.2.1 Zoom

The Zoom button enables the user to select any rectangular area on the currently displayed map and magnify this region. Zoom always operates on the last area selected. (The last area selected is the last entry in the listing of the Remove a Selected Operating Area dialog, described in section 5.2.4.)

Before a zoom can be performed, an area must be selected (see section 5.2 for details). Once an area has been selected, selecting the Zoom button will enlarge the selected area, replacing the previously displayed map. The enlarged area will be removed from the list of selected areas (which may be viewed in the Remove a Selected Operating Area dialog, described in section 5.2.4). All other previously selected areas that fall within the zoomed area will be shaded. From this new map view, an operating area may be selected. An example of an enlarged mapping area is illustrated in figure 9.

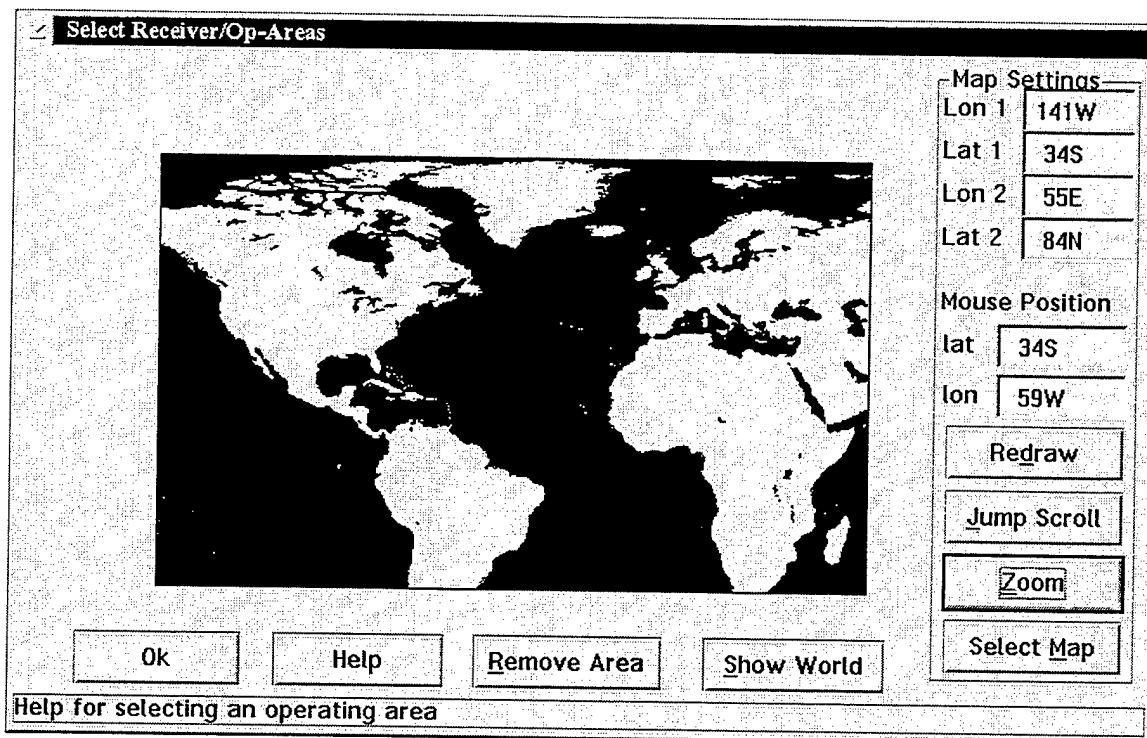


Figure 9. Example of an Enlarged Mapping Area.

5.2.2 Selecting a Map

A series of predefined maps have been provided in the SCAT program. This list of predefined areas is not modifiable by the user. To view this list, select the Select Map button. This will start the Select Map Area dialog, illustrated in figure 10. To dismiss the dialog, select the Ok button. To dismiss the dialog without saving the selections, select the Esc=Cancel button. For on-line help with selecting a predefined map, select the Help button. To display a map from this list, double-click with the left mouse on the desired map.

5.2.3 Jump Scroll

The Jump Scroll button allows the user to move the displayed map 20% to the left. This action must be performed before selecting an operating area crossing longitudinal boundaries of the currently displayed map.

5.2.4 Remove Area

The Remove Area button allows the user to remove a previously selected operating area or view the list of selected areas. A list of selected operating areas will be displayed in the Remove a Selected Operating Area dialog, as illustrated in figure 11. Position the mouse pointer over the area to be removed and double-click with the left mouse button; the selected area will be deleted from the list. When all the desired areas have been deleted, select the Ok button to save the changes and dismiss the dialog. To dismiss the dialog without saving the selections, select the Cancel button. For on-line help with removing an operating area, select the Help button.

5.2.5 Selecting a Center Point

When displaying coverage charts using the gnomonic, azimuthal, or orthographic projections, the user can specify a center point for the plot by selecting a single point on the "Select Receiver/Op-Area" dialog. This single point will be used to provide the MotionVLF display program (described in section 8.6) with the map's center. If a center point is not specified, the SCAT will determine the center point for these projections based on the middle of the currently displayed map in the "Select Receiver/Op-Area" dialog. Specifying the center point is of particular importance when an arctic plot is desired. To select a center point at the pole, position the mouse pointer at the top of the map and press and release the left mouse button when the coordinates in the "mouse position lat" field reads 90°N, and the desired center longitude is displayed.

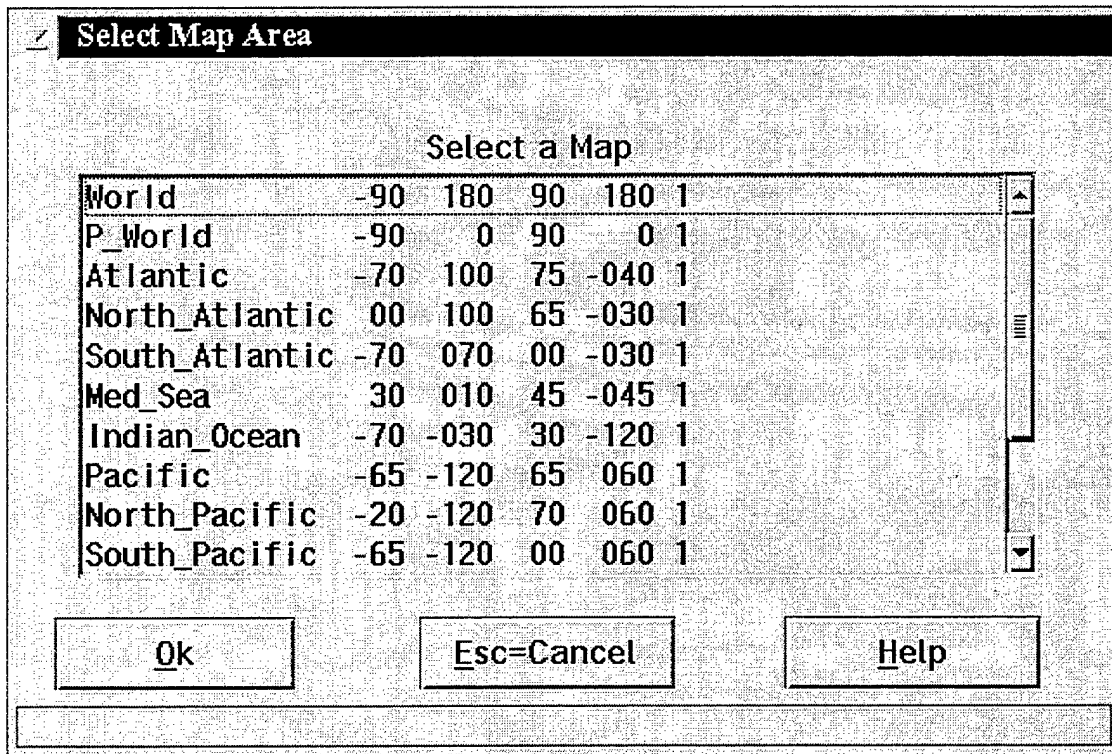


Figure 10. Select Map Area Dialog.

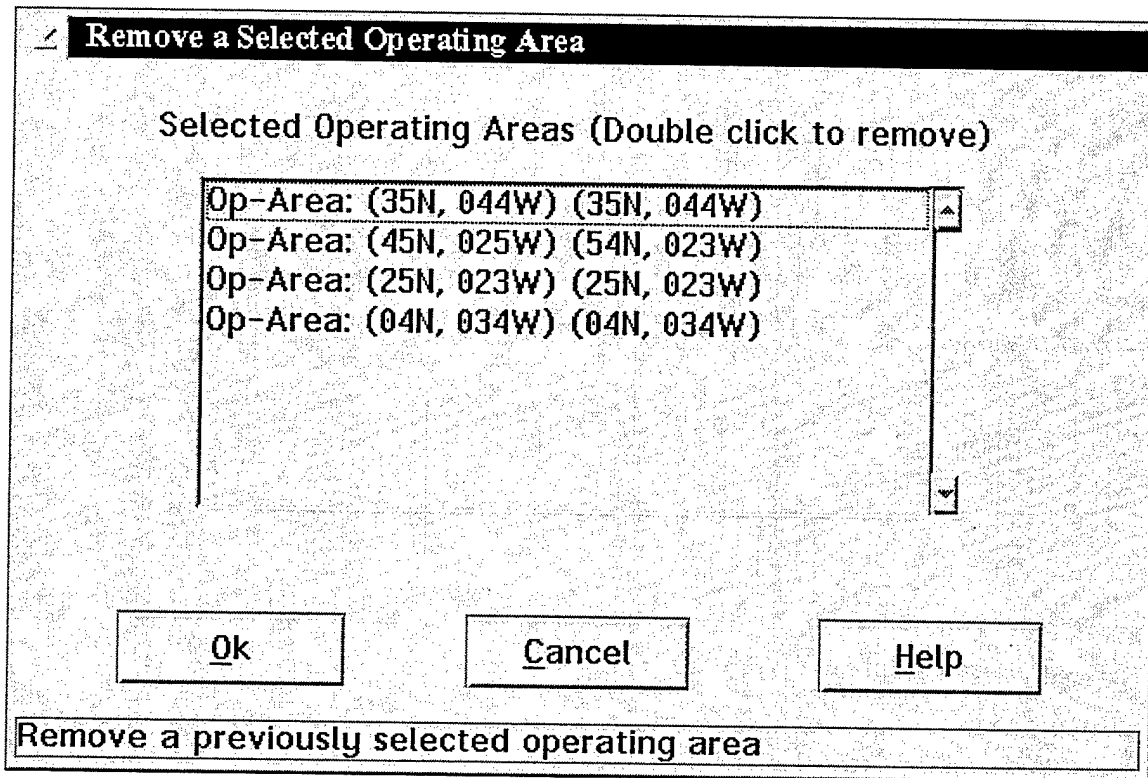


Figure 11. Remove a Selected Operating Area Dialog.

5.3 SELECTING AN ARCTIC OPERATING AREA

To begin selection of an arctic operating area, select Scenario Selection ->Select Operating Area (Arctic). This will start the Select Arctic Receiver/Op-Areas dialog, illustrated in figure 12. This dialog provides for the selection of one to ten receiver/operating areas using an arctic view for the selection process. The SCAT uses only water areas in its analysis, thus signal and noise values over land masses enclosed by selected operating areas are not used when performing calculations.

Area selections and removals are performed as previously described in section 5.2.

To save your selections and dismiss this dialog, press the OK button. To exit from this dialog without saving the previous area selections, press the Cancel button. To obtain help with selecting an operating area using the arctic map, press the Help button.

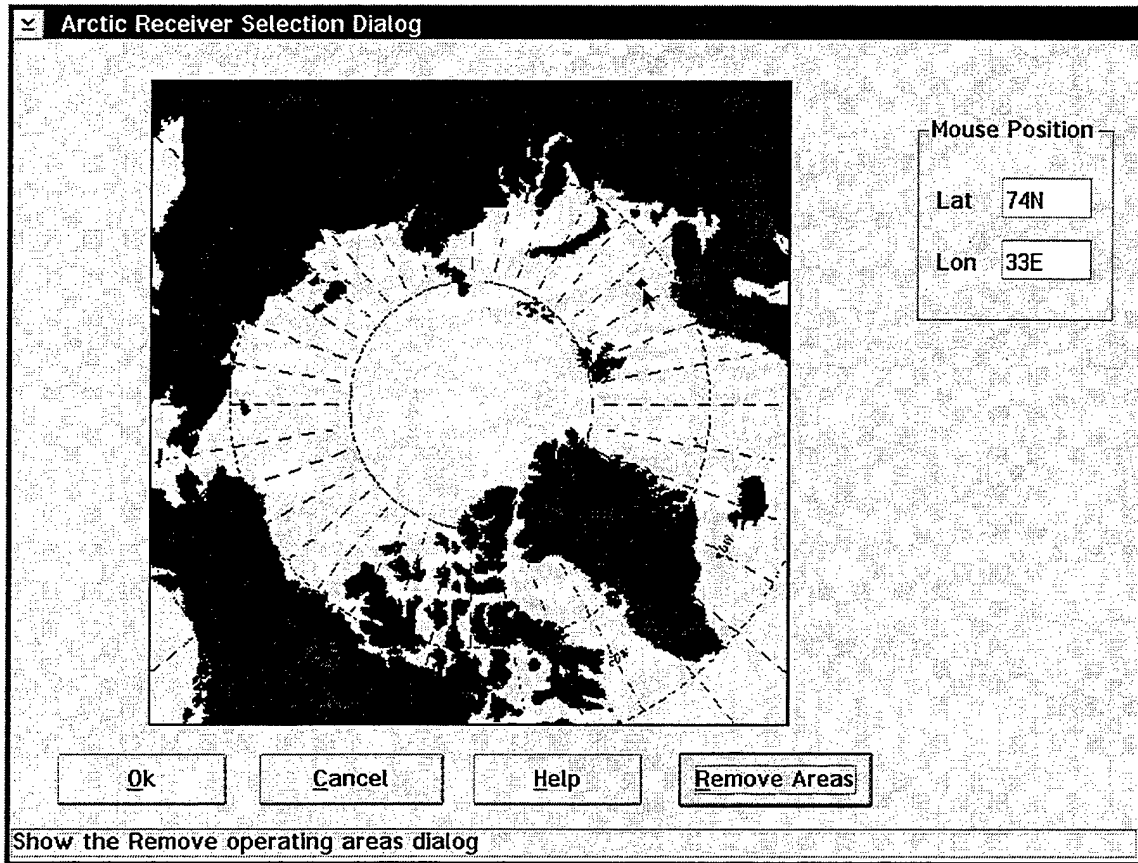


Figure 12. The Arctic Operating Area Selection Dialog.

5.4 SELECTING AN AVAILABILITY LEVEL

The availability level specifies a safety factor that is applied to the coverage predictions to allow for prediction uncertainties and day-to-day time variations. For example, an availability of 90% means that, in the long run, 90% of the field experience will be at least as good as predicted, assuming the received SNR is essentially the same as that received by an omnidirectional antenna at the ocean surface.

To select an availability level, select Scenario Selection -> Availability. This menu item allows for selection of a single availability level of 50%, 90% (default level), 99%, or a user-defined level (from 1% to 99%). The selected availability level will be used for all of the transmitter(s) and areas selected. A check mark will be displayed next to the selected level (if the menu item is re-inspected).

To select a user-defined level, select Scenario Selection -> Availability -> User Specified.... This will start the Select Availability Level dialog, illustrated in figure 13. To select an availability level from this dialog, double-click on the desired availability level. This will select the requested availability level and dismiss the dialog. The user may also single click on the desired availability level, and then press the Ok button to dismiss the dialog. To dismiss the dialog without saving the selection, select the Esc=Cancel button. For on-line help when selecting an availability level, select the Help button.

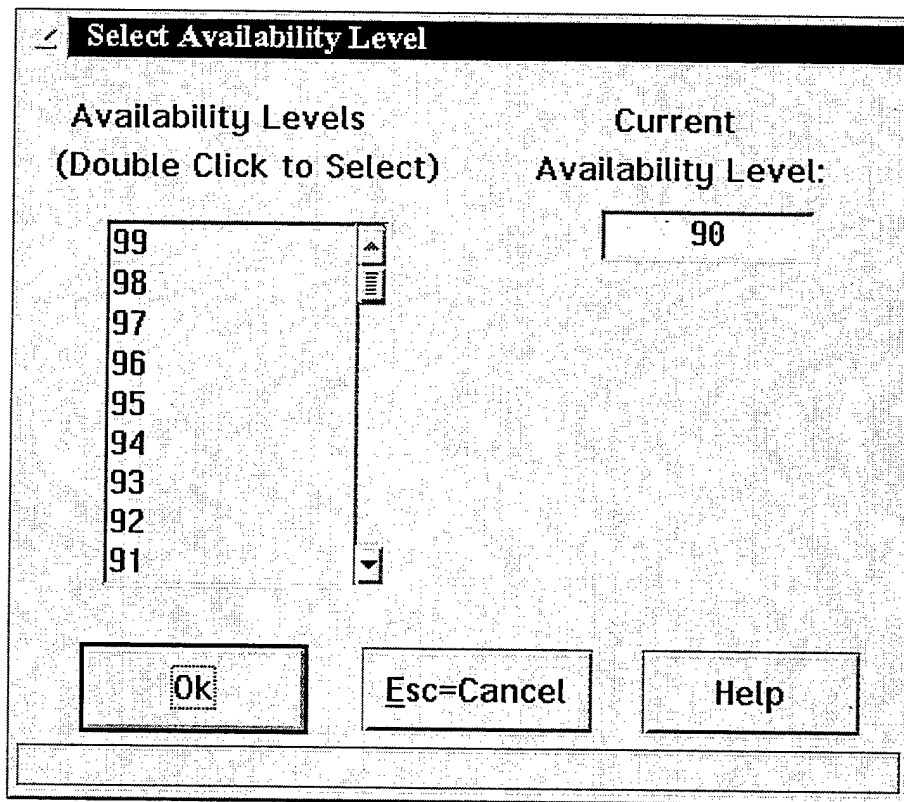


Figure 13. Select Availability Level Dialog.

5.5 SELECTING A SEASON AND TIME PERIOD

The SCAT program uses a four-season data base that consists of Sep/Oct/Nov, Dec/Jan/Feb, Mar/Apr/May, and Jun/Jul/Aug periods. The SCAT defaults to the Sep/Oct/Nov time period. The SCAT also defaults to performing a 24-hour analysis.

To select a season/time, select Scenario Selection -> Time. This will start the Select a Time for Analysis dialog, illustrated in figure 14. This dialog allows for the selection of a single season and a single time range for use in the analysis. Select a season using the mouse button; the selected season's radio button will be highlighted. To select a specific time period for analysis, select the Specific Time Interval radio button. Select a start time and a stop time (start time must be less than stop time) by selecting the up and down arrows until the desired time interval is displayed in each window. To save the selections and dismiss the dialog, select the Ok button. To dismiss the dialog without saving the selection, select the Esc=Cancel button. For on-line help in selecting a season and a time period, select the Help button.

Select a Time for Analysis

Season

☐ Sep/Oct/Nov

☐ Dec/Jan/Feb

☐ Mar/Apr/May

☒ Jun/Jul/Aug

Time:

☒ 24 Hours

☐ User Specified Time

☐ Specific Time Interval

Start:

Stop:

Figure 14. Select a Time for Analysis Dialog.

5.6 SELECTING A POWER SCHEDULE

To select a power schedule, select Scenario Selection -> Power Schedule. A series of three submenu items will appear. These are Define a Power Schedule, Select Power Schedule, and Review Power Schedule. These menu items allow for the definition of power schedules, selection of a power schedule/transmitter pair, and review of the previously selected transmitter/power schedule associations.

5.6.1 Defining a Power Schedule

To create a power schedule, select the Scenario Selection -> Power Schedule -> Define a Power Schedule menu item. This will display the Define a Power Schedule dialog, illustrated in figure 15. Previously defined power schedules are listed in the Currently Defined Power Schedules list box. The currently selected power schedule's file name is displayed in the Selected Power Schedule Definition Name field. The values of the selected power schedule are displayed in the Power Schedule field. To change the name

of the currently displayed power schedule, edit the contents of the Name: field. To change the currently displayed power schedule, edit the contents of the Power Schedule field. The power schedule must be entered in the following format (at least one line must be present in the file, and an entry can be made for every 30-minute time period, if desired):

start_time	stop_time	power_level
start_time	stop_time	power_level
start_time	stop_time	power_level

The start and stop times should be specified using 30-minute time periods (i.e., if the previous stop time was 1200, the next start time should be 1230). The SCAT does not perform error checking on the input power schedule; thus, it is important for the user to correctly enter the power schedule using the above guidelines.

To save a power schedule, select the Save button. To dismiss this dialog without saving any changes, select the Ok button. For on-line help with defining a power schedule, select the Help button.

Power Schedule		
Start	Stop	Power (kw)
0000	0800	0150
0830	1200	1200
1230	1800	0300
1830	2200	1200
2230	2400	0150

Figure 15. Define/Modify Power Schedules Dialog.

5.6.2 Associating a Power Schedule with a Transmitter

To use a power schedule after it has been defined, it must be associated with one of the previously selected transmitters. To associate a transmitter with a power schedule, select the Scenario Selection -> Power Schedule -> Select Power Schedule menu item. This will display the Associate a Power Schedule with a Transmitter dialog, illustrated in figure 16. All previously defined power schedules will be displayed in the Available Power Schedules list box. All of the previously selected transmitters will be displayed in the Available Transmitters list box. To associate a power schedule with a transmitter, select a power schedule and a transmitter from their respective lists and select the Associate button. This will create an association

between this power schedule and transmitter, and the selected power schedule will be used for communications assessment requests that involve the transmitter.

To review previous associations, select the Review Associations button. This will display the Review/Remove Power Schedule Associations dialog, illustrated in figure 17. To dismiss this dialog, select the Ok button. For on-line help with associating a power schedule to a transmitter, select the Help button.

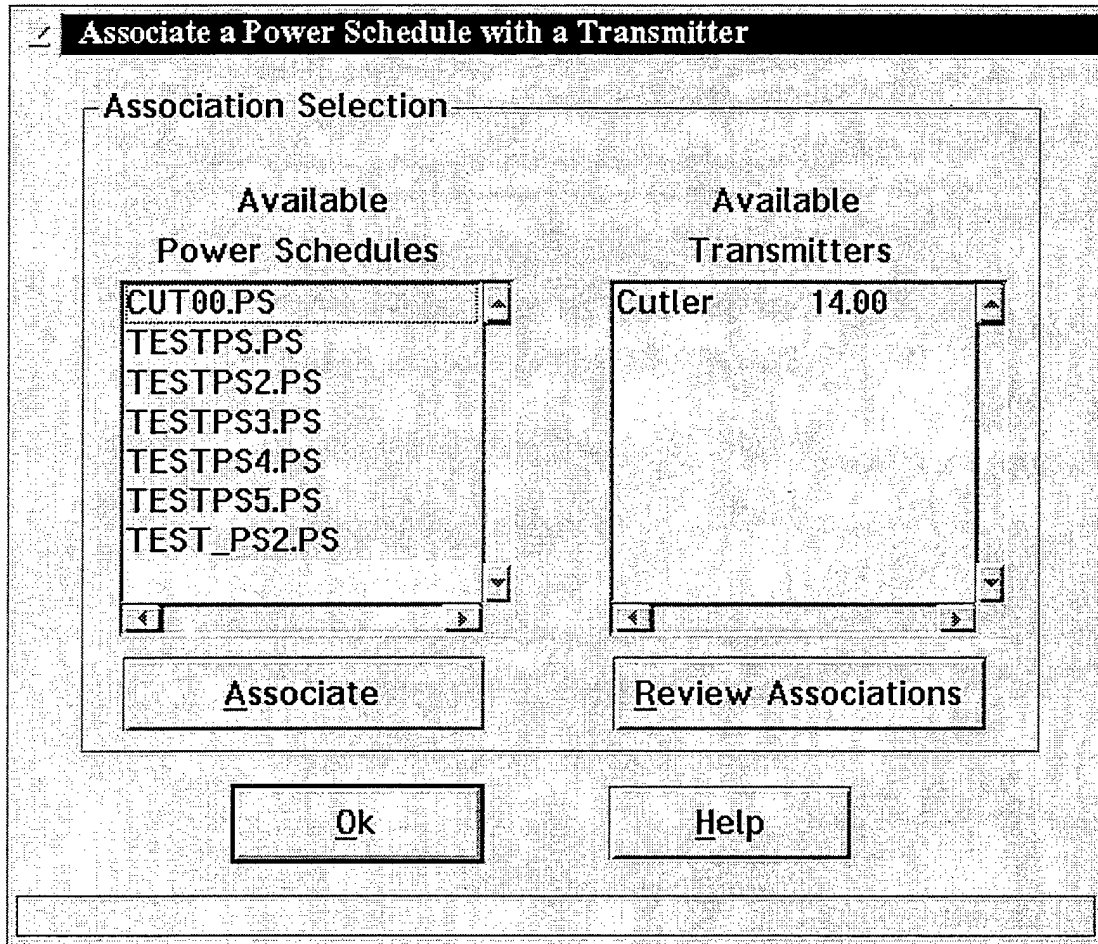


Figure 16. Associate a Power Schedule with a Transmitter Dialog.

5.6.3 Reviewing or Removing Power Schedule Associations

To review or remove a power schedule/transmitter association, select the Scenario Selection -> Power Schedule -> Review Power Schedules menu item. This will display the Review/Remove Power Schedule Associations dialog, illustrated in figure 17. To remove an association, position the mouse pointer over the desired power schedule/transmitter pair and double-click using the left mouse button. The selected association will be removed from the list of associations. To dismiss this dialog, select the Ok button. For on-line help with reviewing/removing a power schedule/transmitter association, select the Help button.

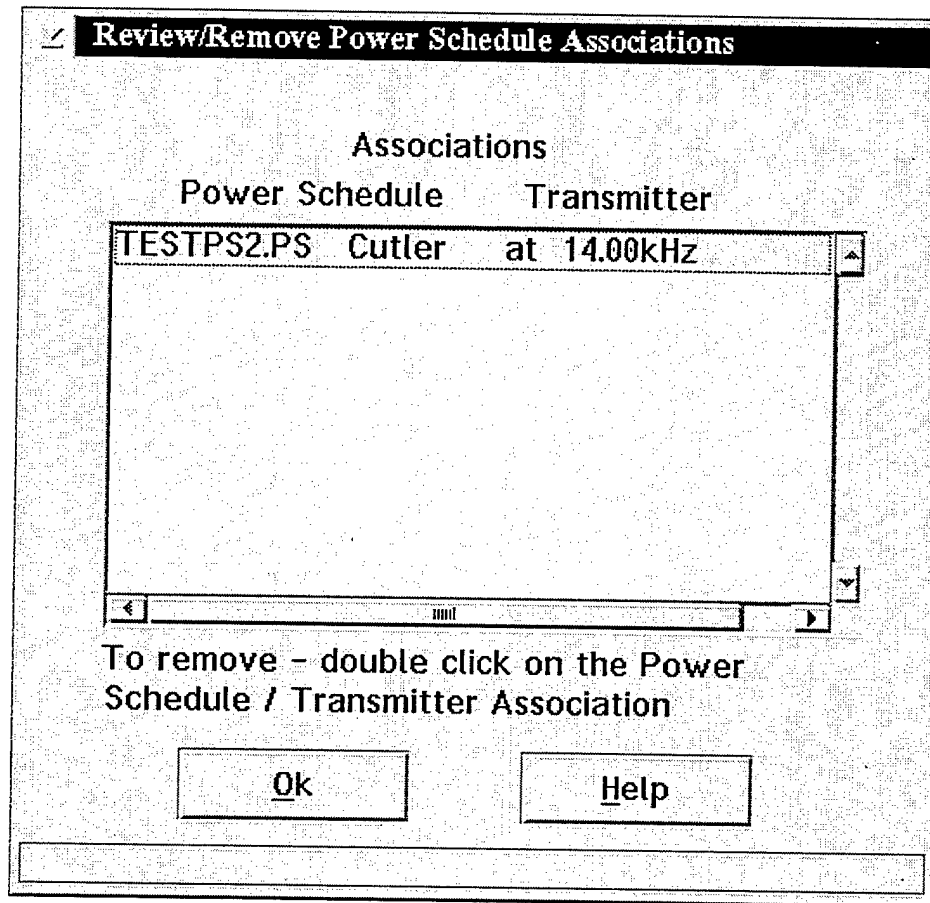


Figure 17. Review/Remove Power Schedule Associations Dialog.

SECTION 6

RUNNING A SCENARIO

Once all of the desired selections have been made (see section 5), including the required selections of at least one transmitter and one receiver area, a coverage assessment can be conducted. THE SCAT provides for five different analyses:

- A determination of the percentage of full power for each of the selected transmitter(s) that is required to fully cover the combined selected receiver area(s). To perform a Percentage of Power analysis, select Run Scenario -> Show Percent Power.... An example of the resulting hard copy is shown in figure 18.
- A plot of the minimum SNR of the combined selected areas for each of the selected transmitter(s). To perform an SNR analysis, select Run Scenario -> Show SNR.... An example of the resulting hard copy is shown in figure 19.
- A determination of the minimum power, in kW, required to be output by each of the transmitter(s) to fully cover the combined selected receiver area(s). To perform a Minimum Power analysis, select Run Scenario -> Show Power Levels.... An example of the resulting hard copy is shown in figure 20.
- A time availability plot that illustrates copy/no copy periods for the selected transmitter operating area pairs. To perform a Time Availability plot, select Run Scenario -> Show Time Availability.... An example of the resulting hard copy is shown in figure 21.
- A minimum composite SNR plot of the selected operating areas and transmitters selected. To perform a minimum composite plot, select Run Scenario -> Show SNR Composite (MIN)... An example of a minimum composite SNR chart is shown in figure 22.
- A maximum composite SNR plot of the selected operating areas and transmitters selected. To perform a maximum composite plot, select Run Scenario -> Show SNR Composite (MAX)... An example of a maximum composite SNR chart is shown in figure 23.
- A series of coverage charts can be produced for a selected transmitter (using the last map area selected). Various options (described in section 4.4) may be selected. To view the selected series of coverage charts, select Run Scenario -> Show Single Coverage... or Run Scenario -> Show Joint Coverage.... Controls for viewing the coverage charts are described in section 8.6. An example of the resulting hard copy is shown in figure 24.

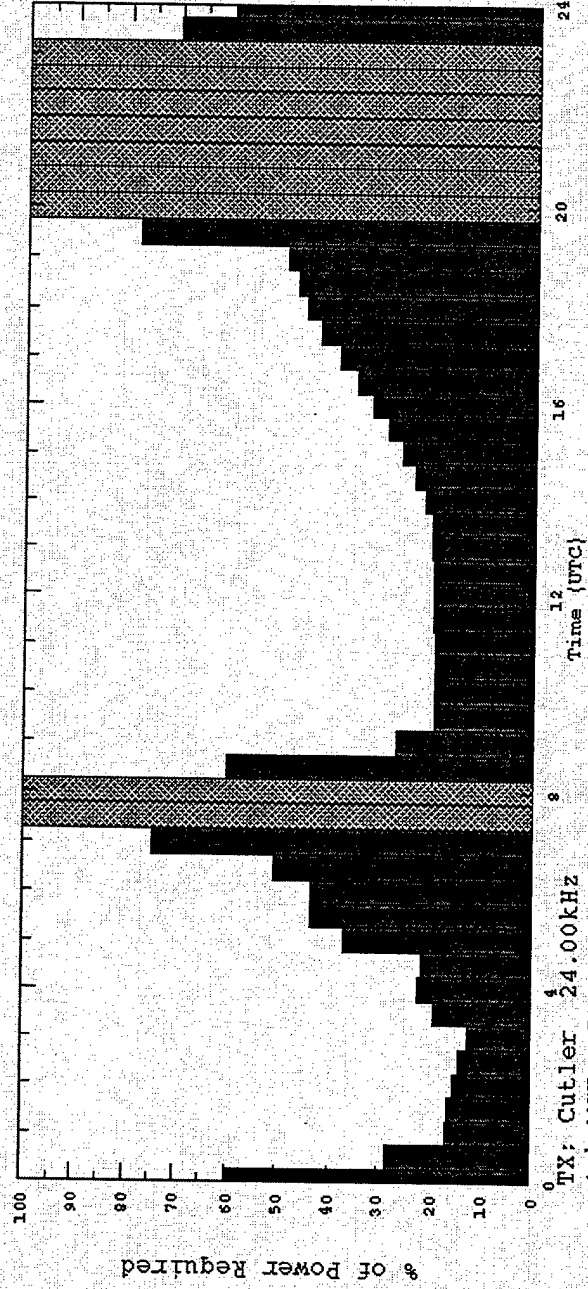
While THE SCAT is processing the requested data, a status summary is displayed in the SCAT main menu window. This display shows the frequency and hour for the data file currently being processed. Once all of the required data files have been processed, the resulting histogram or chart is displayed. (Note: the operator may not halt an analysis started by the Run Scenario menu during processing.)

On the screen, the histograms are color-coded in the following manner:

- Green - the transmitter is capable of covering the selected area(s).
- Red - the transmitter is not able to cover the selected area(s) at its current maximum radiated power level and mode of transmission.

To obtain a hard copy of the displayed histogram or coverage chart, select the Print button (an OS/2 compatible printer must be attached to the system and defined as the default printer for the operating system). To save the displayed chart in the Hewlett Packard Graphics Language (HPGL) format, press the Save button. To dismiss the dialog and return to the SCAT main menu from any Run Scenario menu, select the Ok button or Esc=Cancel button.

Histogram Display



Ok

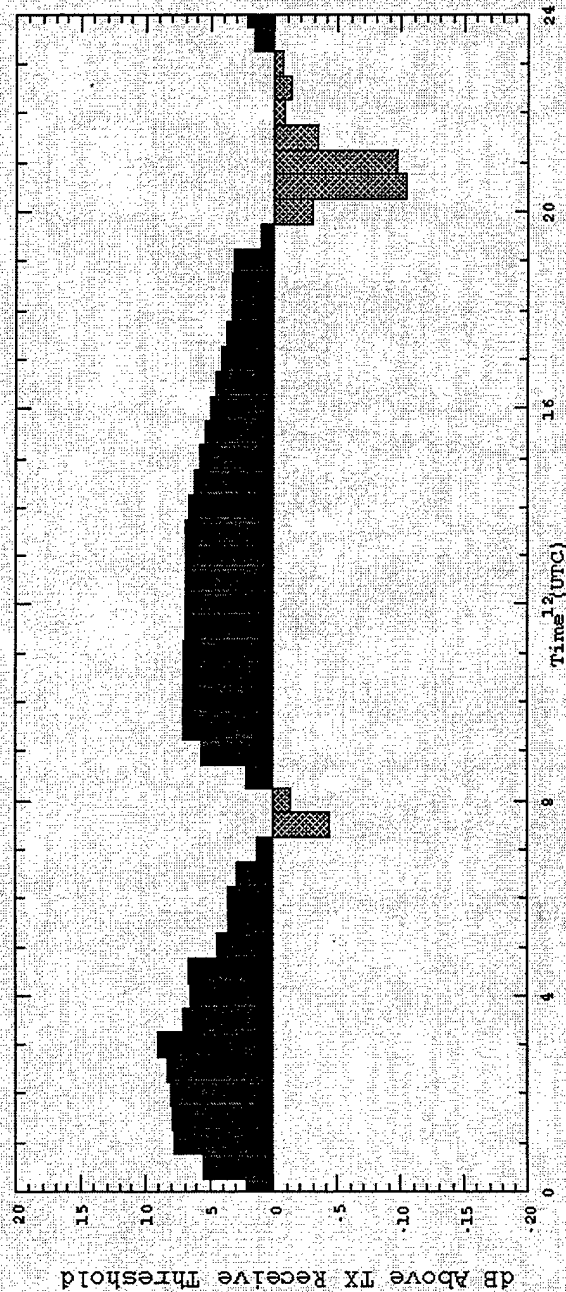
Esc=Cancel

Print

Save

Figure 18. Example of Percentage of Power Histogram.

Histogram Display



TX: Cutler 24.00kHz
 Modulation: 4ch MSK Prad: 900.0 (kw)
 Power Schedule Used: None

SCAT Version 5,000
 Season: Jun/Jul/Aug
 Availability = 90%
 Noise Model: NTIA

Operating Areas Selected:
 Op-Area: (42N, 004E) (42N, 004E)

OK

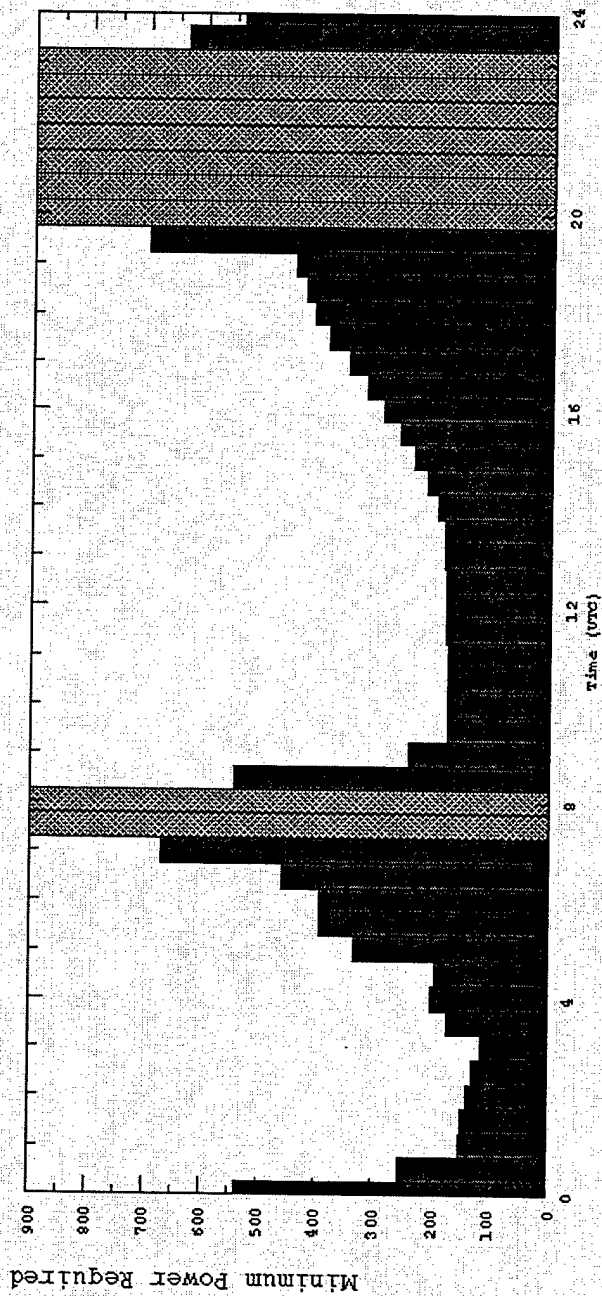
Esc=Cancel

Print

Save

Figure 19. Example of an SNR Histogram.

Histogram Display



TX: Cutler 24.00kHz
4ch MSK PRaD: 900

SCAT Version 5.000
Season: Jun/Jul/Aug
Availability = 90%
Noise Model: NTIA

Operating Areas Selected:
Op-Area: (42N, 004E) (42N, 004E)

OK

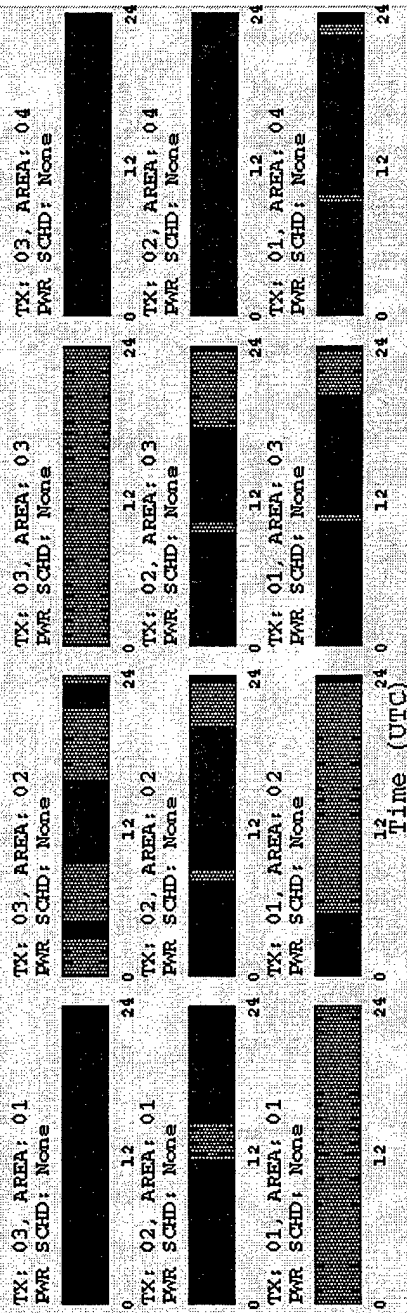
Esc=Cancel

Print

Save

Figure 20. Example of a Power Level Histogram.

Histogram Display



SCAT Version 5.000

TX		Coverage		Season: Jun/Jul/Aug	
Freq	Mode	kw	YES NO	Op-Area 01:	(83N, 013E)
01 40.80	4ch MSK	100.0		Op-Area 02:	(41N, 005E)
02 24.00	4ch MSK	1000.0		Op-Area 03:	(11N, 051W)
03 38.00	4ch MSK	100.0		Op-Area 04:	(39N, 029W)
Availability = 90%					Noise Model: NTIA

Ok

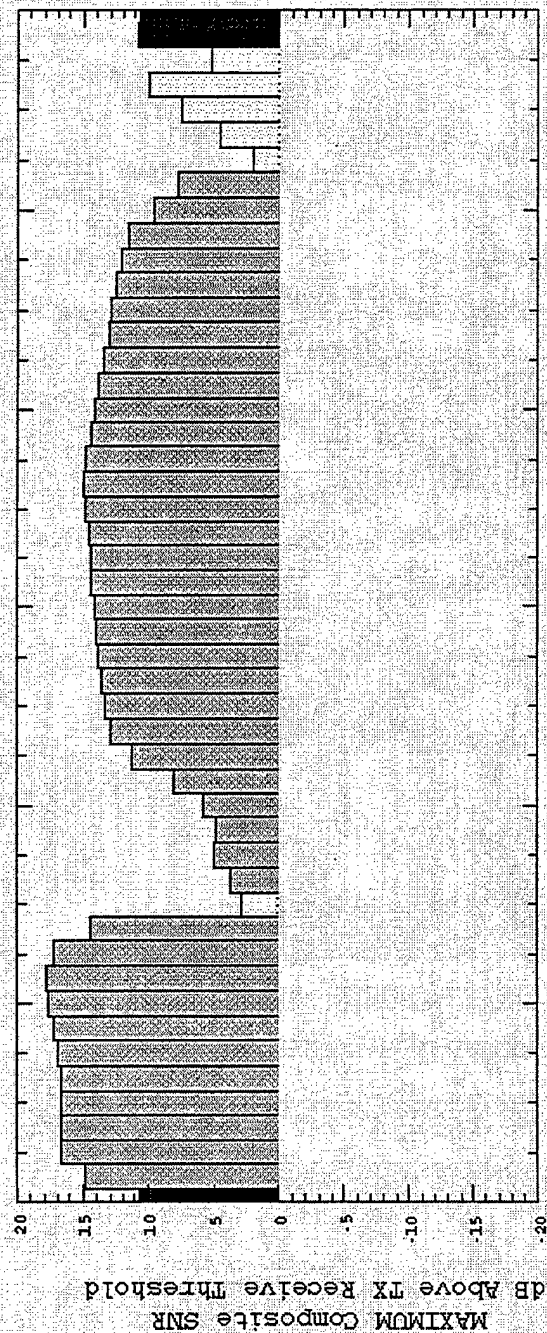
Esc=Cancel

Print

Save

Figure 21 Example of a Time Availability Plot.

Histogram Display



SCAT Version 5.000
Season: Jun/Jul/Aug
Availability = 90%

Operating Areas Selected:
Op-Area: (35N, 010W) (35N, 010W)

OK

Esc=Cancel

Print

Save

Figure 23 Example of a Maximum Composite SNR Plot.

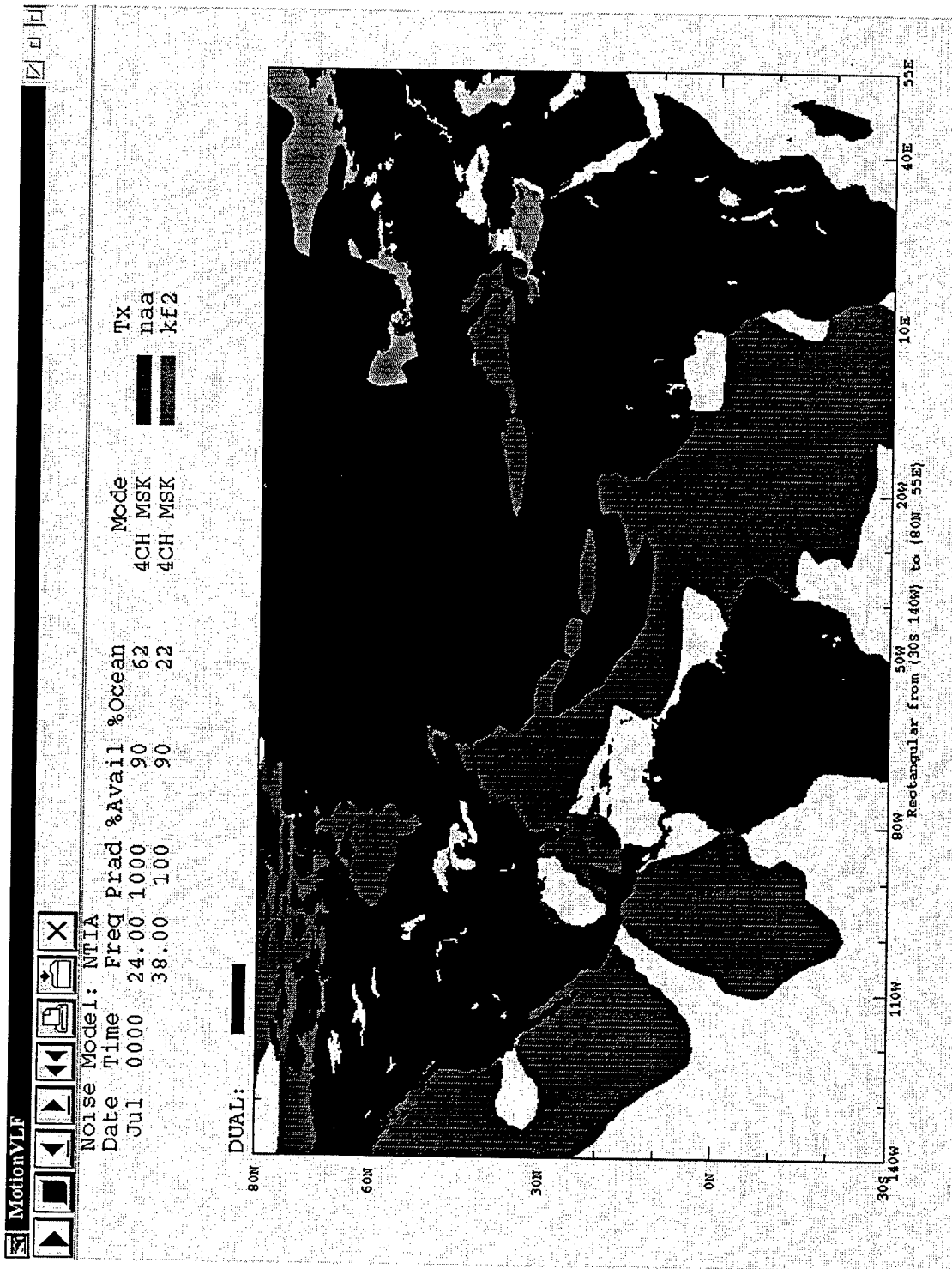


Figure 24. Example of a Coverage Chart.

SECTION 7

MODIFYING A TRANSMITTER'S CHARACTERISTICS

There are two transmitter characteristics that may be modified by the user. These are:

- The transmitter's default radiated power level.
- The transmitter's default mode of modulation (Frequency Shift Keying (FSK), 2-channel Minimum Shift Keying (MSK), and 4-channel MSK).

For the SCAT, the transmitter's maximum radiated power level is predefined as the standard radiated power. However, since standard radiated power may change, the SCAT allows the user to change a transmitter's maximum radiated power level (as well as its mode of modulation). To change a transmitter's maximum power or mode, select File -> Modify Tx Data... from the SCAT main menu. This will initiate the Modify Transmitters Characteristics dialog, illustrated in figure 25.

To modify a transmitter's characteristics, perform the following steps:

- Select a transmitter from the Available Transmitters list box. The selected transmitter's default modulation and maximum power level will be displayed in the Selected Transmitters Characteristics group box.
- To modify the transmitter's mode, click on the desired modulation (either 2-channel MSK, 4-channel MSK, or FSK). To use a non-standard value, click on the "Other" radio button and manually enter in the desired dB level.
- To change the transmitter's maximum radiated power level, select a new power level from the Maximum Power list box by either single- or double-clicking on the desired new maximum power level, scrolling through the possible power levels by using the up and down arrows.
- Once the new power and/or modulation for the transmitter have been selected, select the Save Modifications button to save the changes.

To change the characteristics for another transmitter, select another transmitter from the Available Transmitters list box and repeat the steps above.

When all desired changes have been made, select the Ok button to dismiss the dialog and return to the SCAT main menu. To dismiss the dialog without saving changes made subsequent to selecting the Save Modifications button, select the Esc=Cancel button. To obtain on-line help, select the Help button.

Modify Transmitters Characteristics

Available Transmitters
(Highlight Tx to modify)

Aguada	40.80
Anthorn	19.00
Anthorn	21.30
Anthorn	21.30
Awase	54.00
Criggion	19.60
Cutler	14.00
Cutler	15.00
Cutler	16.00
Cutler	17.00
Cutler	18.00
Cutler	19.00
Cutler	20.00
Cutler	21.00
Cutler	22.00

Selected Transmitters Characteristics

Transmitter: Aguada
Frequency: 40.80
Current Max Power: 100

Tx Mode:

☐ 2 Ch MSK
☒ 4 Ch MSK
☐ FSK
☐ Other

Maximum Power

1
2
3
4
5

dB

Save Modifications

Ok Esc=Cancel Help

Figure 25. Modify Transmitter Characteristics Dialog.

SECTION 8

EXAMPLES

This section provides examples in using the SCAT program. It is assumed that these examples will be performed in the order given to eliminate repetition of steps that do not need to be repeated.

1. Perform single-transmitter, default mode, single-area, percentage of power analysis.
2. Add another area selection and select multiple modes of transmission for a minimum power analysis.
3. Deselect multiple modes of transmission and change default availability level to 50% for an SNR analysis.
4. Select a user-specified availability level for a percentage of power analysis.
5. Select a season and time interval and remove an operating area for a time availability analysis.
6. View coverage charts for a single transmitter.

8.1 SINGLE-TRANSMITTER ANALYSIS

This example shows how to use the SCAT program using defaults for all settings except the selected transmitter and operating area. This will be used as the basis for all of the other examples in this section. To perform a basic analysis, the following steps should be taken.

8.1.1 Starting SCAT

To start the SCAT program, either type SCAT from an OS/2 command line or double-click on the SCAT program icon.

8.1.2 Selecting a Transmitter

To select a transmitter, perform the following steps:

1. Select the Senario Selection menu item to display the submenu items.
2. Select the Select Transmitters... submenu item to display the Select Transmitters dialog.
3. Select the first transmitter in the list by clicking on the transmitter's name (i.e., Cutler).
4. Select the Ok button to dismiss the Select Transmitters dialog and redisplay the SCAT main menu.

8.1.3 Selecting an Operating Area

To select an operating area, perform the following steps:

1. Select the Senario Selection menu item to display the submenu items.
2. Select the Select Operating Area... submenu item to display the Select Receiver/Op-Areas dialog.
3. Position the mouse pointer at one corner of the desired operating area on the map; draw a small box by pressing and holding down the left mouse button while moving the pointer to the opposite corner. While the mouse button is being held down, an outline box will surround the selected area; when the button is released, the operating area will be represented by a shaded rectangle.
4. Select the Ok button to dismiss the Select Receiver/Op-Areas dialog and redisplay the SCAT main menu.

8.1.4 Generating Percentage of Power Analysis

To generate the percentage of power analysis, perform the following steps:

1. Select the Run Scenario menu item to display the submenu items.
2. Select the Show Percent Power... submenu item to begin generation of the percentage of power histogram.

8.2 STANDARD AVAILABILITY LEVELS

This example illustrates how to select from one of the three standard availability levels (50%, 90%, or 99%).

8.2.1 Selecting a Transmitter

To select only one mode of transmission, perform the following steps:

1. Select the Scenario Selection menu item to display the submenu items.
2. Select the Select Transmitters... submenu item to display the Select Transmitters dialog.
3. Deselect all but one mode of transmission by clicking on the checked boxes for the transmitter. Only the selected box will still have a check mark in it.
4. Select the Ok button to dismiss the Select Transmitters dialog and redisplay the SCAT main menu.

8.2.2 Selecting a Standard Availability Level

To select one of the standard availability levels, perform the following steps:

1. Select the Scenario Selection menu item to display the submenu items.
2. Select the Availability submenu item to display the submenu items.
3. Select the 50% submenu item. That item will get a check mark next to it, and the SCAT main menu will be redisplayed.

8.2.3 Generating the SNR Analysis

To generate the SNR analysis, perform the following steps:

1. Select the Run Scenario menu item to display the submenu items.
2. Select the Show SNR submenu item to begin generation of the SNR histogram.

8.3 USER-SPECIFIED AVAILABILITY LEVEL

This example illustrates how to select a user-specified availability level.

8.3.1 Selecting a User-Specified Availability Level

To select a user-specified availability level, perform the following steps:

1. Select the Scenario Selection menu item to display the submenu items.
2. Select the Availability submenu item to display the submenu items.
3. Select the User Specified... submenu item to display the Select Availability Level dialog.

4. A list of all possible availability values will be displayed in the Availability Levels list box. Double-click on one of the availability levels. This value will be displayed as the Current Availability Level, the dialog will be dismissed, and the SCAT main menu will be redisplayed.

8.3.2 Generating Percentage of Power Analysis

To generate the percentage of power analysis, perform the following steps:

1. Select the Run Scenario menu item to display the submenu items.
2. Select the Show Percent Power... submenu item to begin generation of the percentage of power histogram.

8.4 TIME INTERVAL

This example illustrates how to select a time interval for analysis (the default is for SCAT to perform a 24-hour analysis).

8.4.1 Selecting a Time Interval

To select a time interval, perform the following steps:

1. Select the Scenario Selection menu item to display the submenu items.
2. Select the Time... menu item to display the Select a Time for Analysis dialog.
3. Select the Specific Time Interval radio button. The 24 Hours button will be cleared and the Specific Time Interval button will be darkened, indicating it has been selected.
4. Use the up and down arrow buttons to the right of the Start: window to select a starting time. The time will be displayed in the Start: window. Perform the same process for the stop time. (Note: stop time must be greater than start time.)
5. Select the Ok button to dismiss the Select a Time for Analysis dialog and redisplay the SCAT main menu.

8.4.2 Removing an Operating Area

To remove an operating area, perform the following steps:

1. Select the Scenario Selection menu item to display the submenu items.
2. Select the Select Operating Area... submenu item to display the Select Receiver/Op-Areas dialog.
3. Select the Remove Area button to display the Remove a Selected Operating Area dialog.
4. Double-click on the first two areas in the list. Those areas will be deleted from the list, and only the last area selected will remain displayed.
5. Select the Ok button to save the changes, dismiss the Remove a Selected Operating Area dialog, and redisplay the SCAT main menu.

8.4.3 Generating the Time Availability Analysis

To generate the time availability analysis, perform the following steps:

1. Select the Run Scenario menu item to display the submenu items.
2. Select the Show Time Availability... submenu item to begin generation of the time availability plots.

8.5 GENERATING A COVERAGE CHART

To generate coverage charts, select from one to four transmitters. The program will use the currently selected mapping area (see selecting operating areas) as its display map. The parameters for viewing the coverage charts may be changed using the Options menu (see section 4.4).

1. Select the Run Scenario menu item.
2. Select the Show Single Coverage... submenu item to begin viewing coverage charts if only one transmitter has been selected. Select the Show Joint Coverage menu item to begin viewing coverage charts if more than one transmitter has been selected. This will display the Coverage Chart viewer, Motion VLF.

The Motion VLF viewer allows the user to view the selected coverage charts much the same way a video player is used to view a movie. Figure 26 illustrates the Motion VLF user interface. The following functions are provided:



Play - Begins showing coverage charts from the current position.



Stop - Halts the display of the coverage charts.



Single Frame Reverse - Displays one frame previous to the current display.



Single Frame Forward - Displays the next time interval from the current display.



Rewind - Resets the coverage charts to the first one requested.



Print - Prints the currently displayed coverage chart.



Save - Saves the currently selected coverage chart in the Hewlett Packard Graphics Language (HPGL) file format.



Exit - Exits from the coverage chart viewer program and returns to the SCAT main menu.

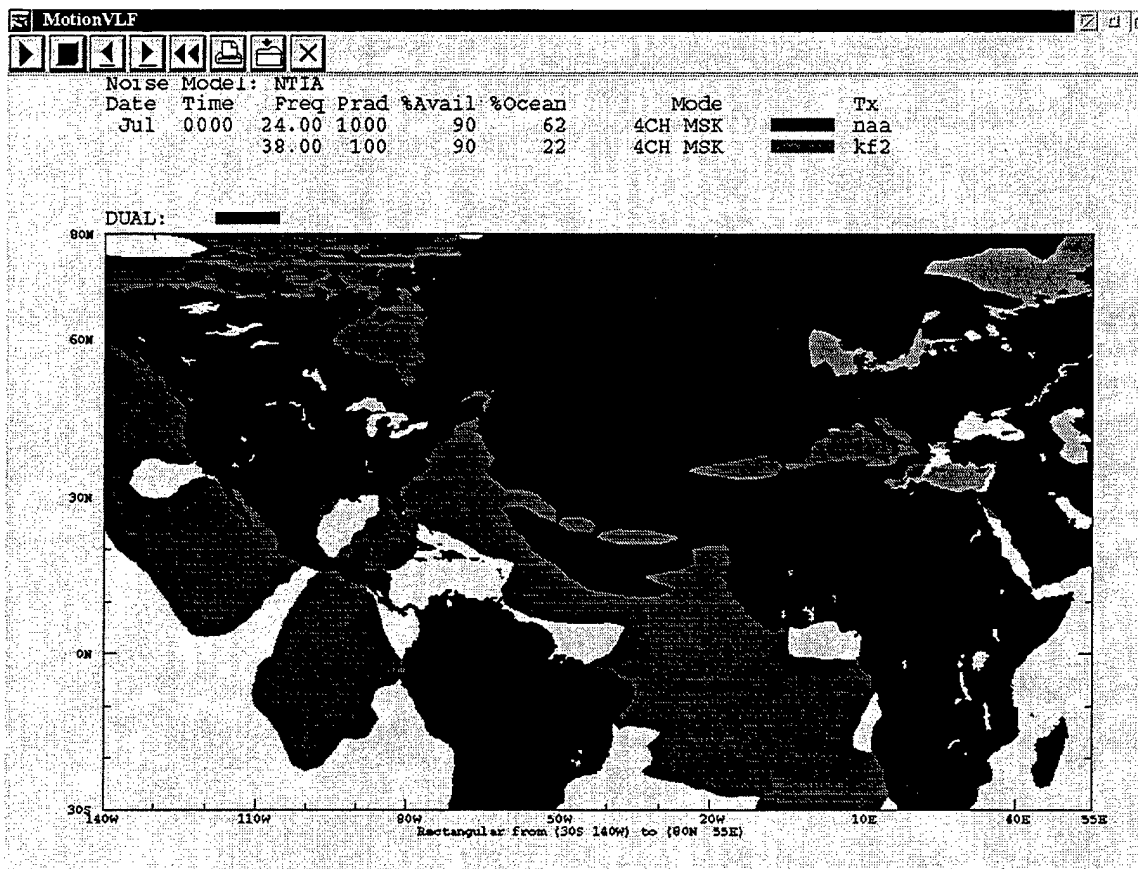


Figure 26. Motion VLF Screen.

SECTION 9

USER PREFERENCES

This section describes the options available to the user through the program's preferences notebook pages. The preferences notebook allows for the selection of values that SCAT will use each time the program is started. These selections include: a default season, map area, time resolution (for coverage charts), selected transmitters, selected operating areas/receivers, default location of data files, and the display of the day/night terminator. To open the preferences notebook, select the File -> Preferences... menu item.

9.1 Season Preference

The season preference page, illustrated in figure 27, allows for the selection of a default season (sep/oct/nov, dec/jan/feb, mar/apr/may, and jun/jul/aug). The user can also select the computers current date as the selection of the season.

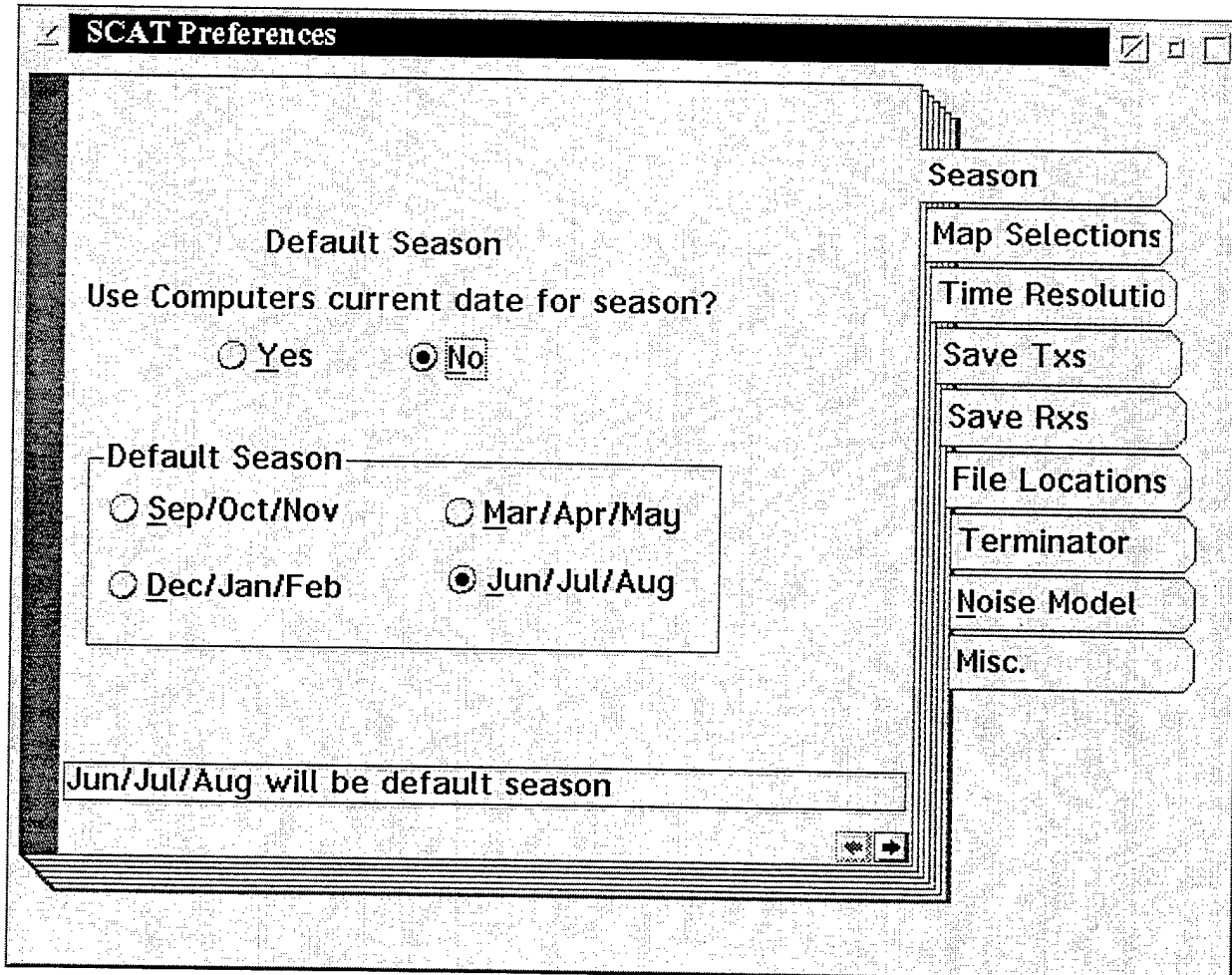


Figure 27. Season Selection Preference Page.

9.2 Map Selection

The Map Selection Preference Page, illustrated in figure 28, allows saving the map that was selected when SCAT was exited to be recalled when SCAT is restarted. It allows for the selection of the default map projection (for coverage charts): rectangular, gnomonic, azimuthal or orthographic. It also allows for the selection of the default map type, which can be no map, a land map, a conductivity map, or a coastal outline map.

The image shows a software window titled "SCAT Preferences". The main area is titled "Default Map Settings". It contains the following options:

- "Save Current Map upon exit?" with radio buttons for **Y** (selected) and **N**.
- "Default Map Projection" with four radio buttons: **Rectangular** (selected), **Azimuthal Equidistant**, **Gnomonic**, and **Orthographic**.
- "Default Map Type" with four radio buttons: **No Map**, **Conductivity**, **Land_Map** (selected), and **Coastal Outline**.
- A checkbox at the bottom labeled "Save currently selected map as default upon exit".

On the right side of the window is a sidebar with several tabs: **Season**, **Map Selections**, **Time Resolutio**, **Save Tx**, **Save Rx**, **File Locations**, **Terminator**, **Noise Model**, and **Misc.**

Figure 28. Map Selection Preference Page.

9.3 Time Resolution

The preferred time resolution for coverage charts can be specified here, as illustrated in figure 29. The available time resolutions are 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours or every 6 hours. This preference page will also permit SCAT to save the currently selected time resolution and use it when SCAT is restarted.

The image shows a software window titled "SCAT Preferences". On the right side, there is a vertical stack of tabs: "Season", "Map Selections", "Time Resolution" (which is currently selected), "Save Tx's", "Save Rx's", "File Locations", "Terminator", "Noise Model", and "Misc.". The main area of the window is divided into two sections. The top section is titled "Time Resolution" and contains the text "Save Time Resolution:" followed by two radio buttons: "Yes" (which is selected) and "No". Below this is another section titled "Default Time Resolution" which contains six radio buttons arranged in two columns. The first column has "30 min", "1 Hour" (selected), and "2 Hour". The second column has "3 Hour", "4 Hour", and "6 Hour". At the bottom of the main area, there is a text box labeled "Save Coverage chart time resolution" and two small navigation buttons (left and right arrows).

Figure 29. Time Resolution Preference Page.

9.4 Save TxS

SCAT can save the currently selected transmitters when the program exits, if requested on the Save TxS preference page, illustrated in figure 30. To save the currently selected transmitters upon exit, select the "Yes" radio button. To not save the currently selected transmitters upon exit, select the "No" radio button.

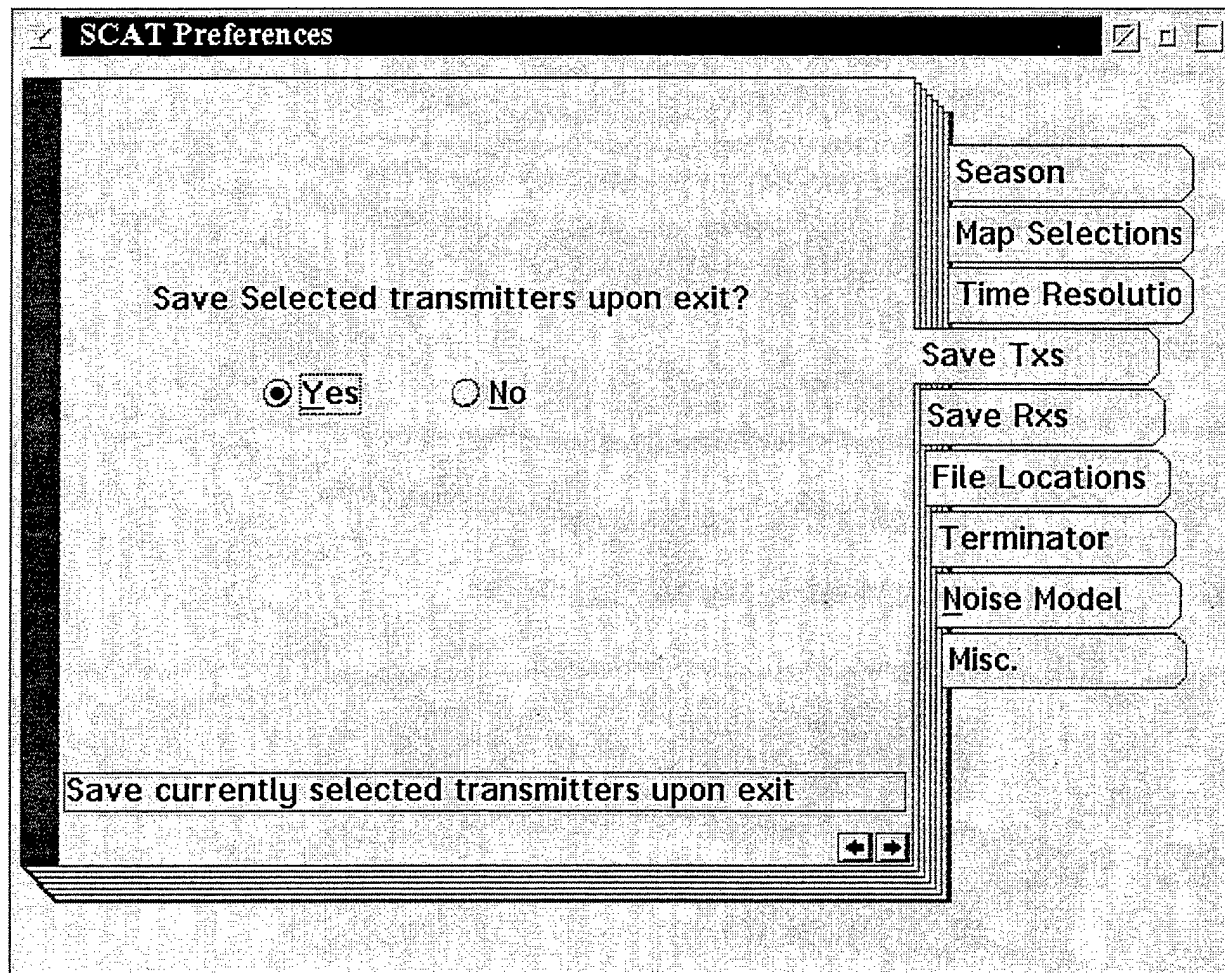


Figure 30. Save TxS Preference Page.

9.5 Save Rxs

SCAT can save the currently selected receivers when the program exits, if requested on the Save Rxs preference page, illustrated in figure 31. To save the currently selected receivers upon exit, select the "Yes" radio button. To not save the currently selected receivers upon exit, select the "No" radio button.

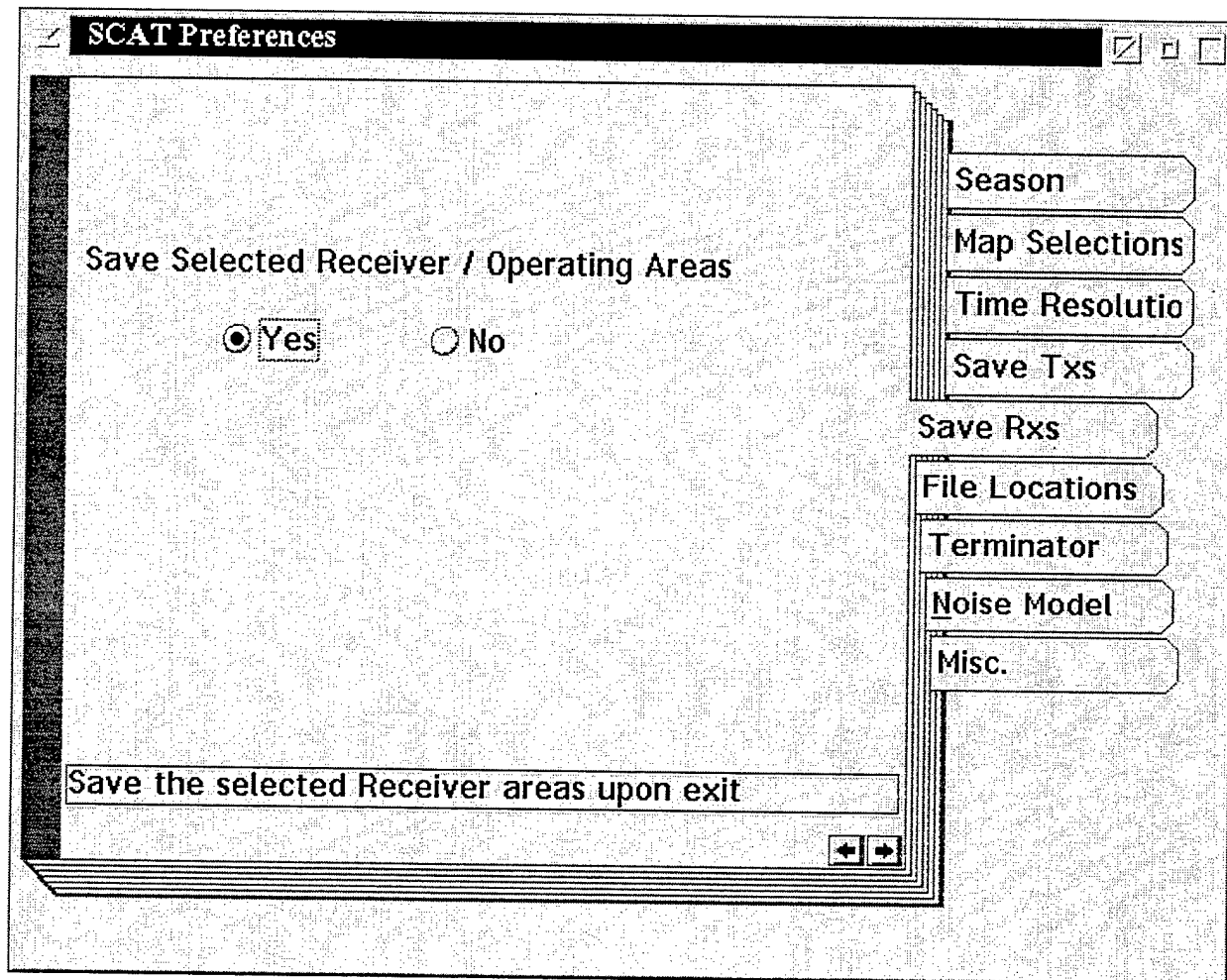


Figure 31. Save Rxs Preference Page.

9.6 File Location

The file location preferences page, illustrated in figure 32, tells SCAT where its data files can be found. The two directories that can be specified are: 1) the location of the SCAT data base, and 2) the location of the SCAT graphics files. These directories are created when SCAT is initially installed by the developer and should not need to be changed.

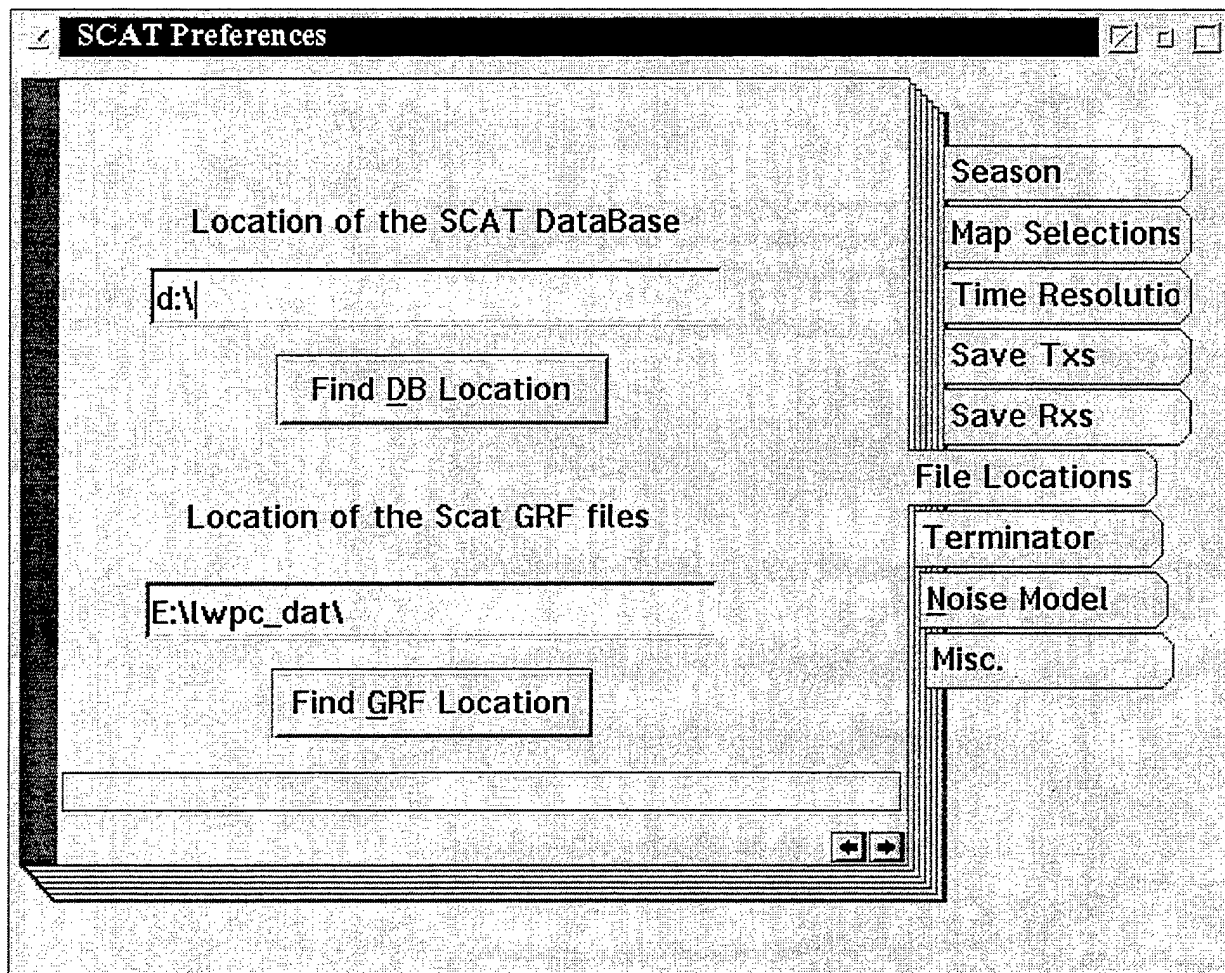


Figure 32. File Location Preference Page.

9.7 Terminator

The terminator preference page, illustrated in figure 33, turns the display of the day/night terminator on or off for coverage charts. If the terminator display is on, three different displays may be selected: 1) a line only representation of the day/night terminator, 2) a filled representation of the terminator (filled areas are night), and 3) a filled and line representation of the terminator.

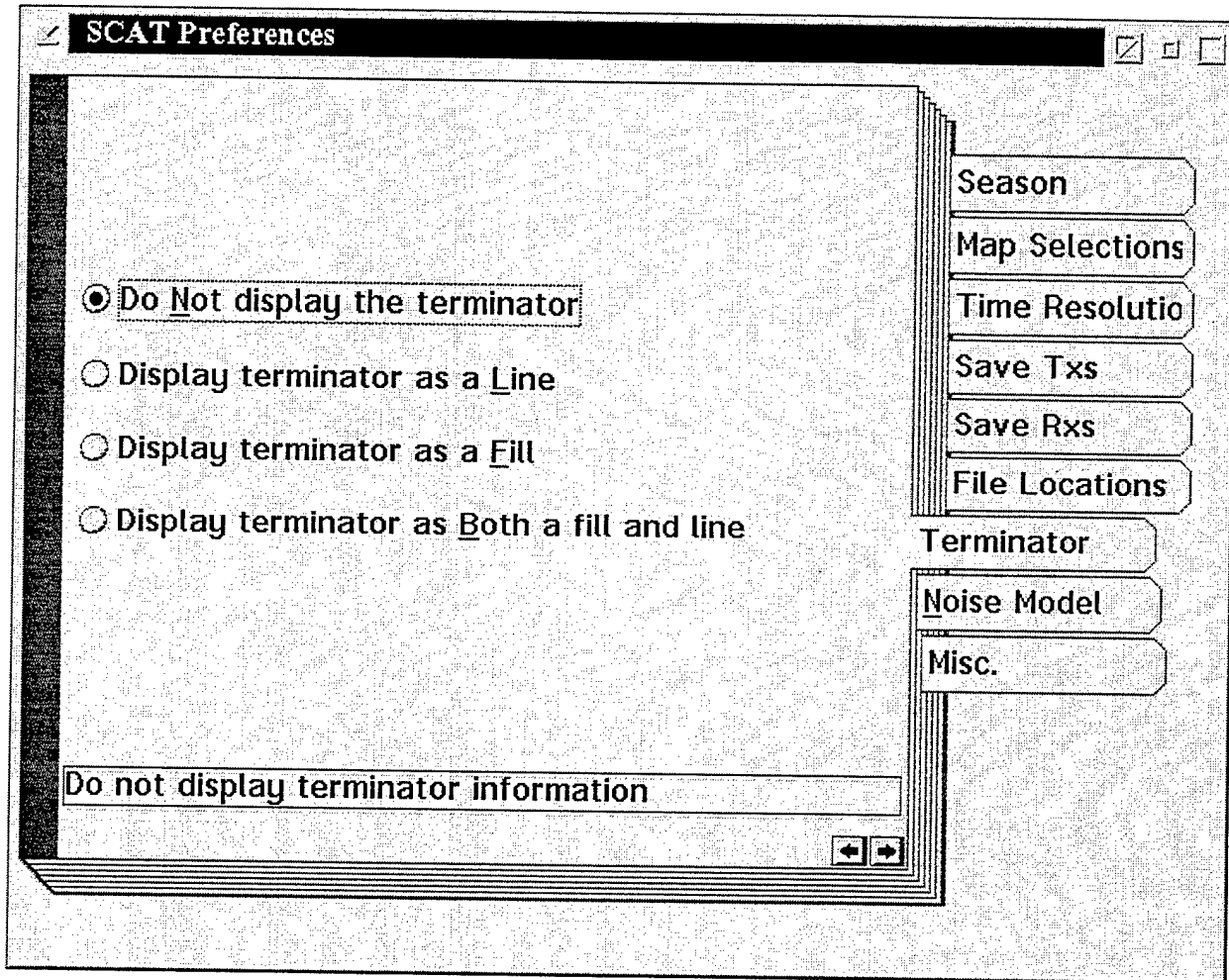


Figure 33. Terminator Preference Page.

9.8 Miscellaneous.

The miscellaneous preferences page, illustrated in figure 34, turns the automatic prompting of a label for each chart on or off. If the "Yes" button is selected, the program will prompt the user for a label before the generation of each histogram or coverage chart. If the "No" button is selected, the program will not prompt the user for a label before each plot is generated.

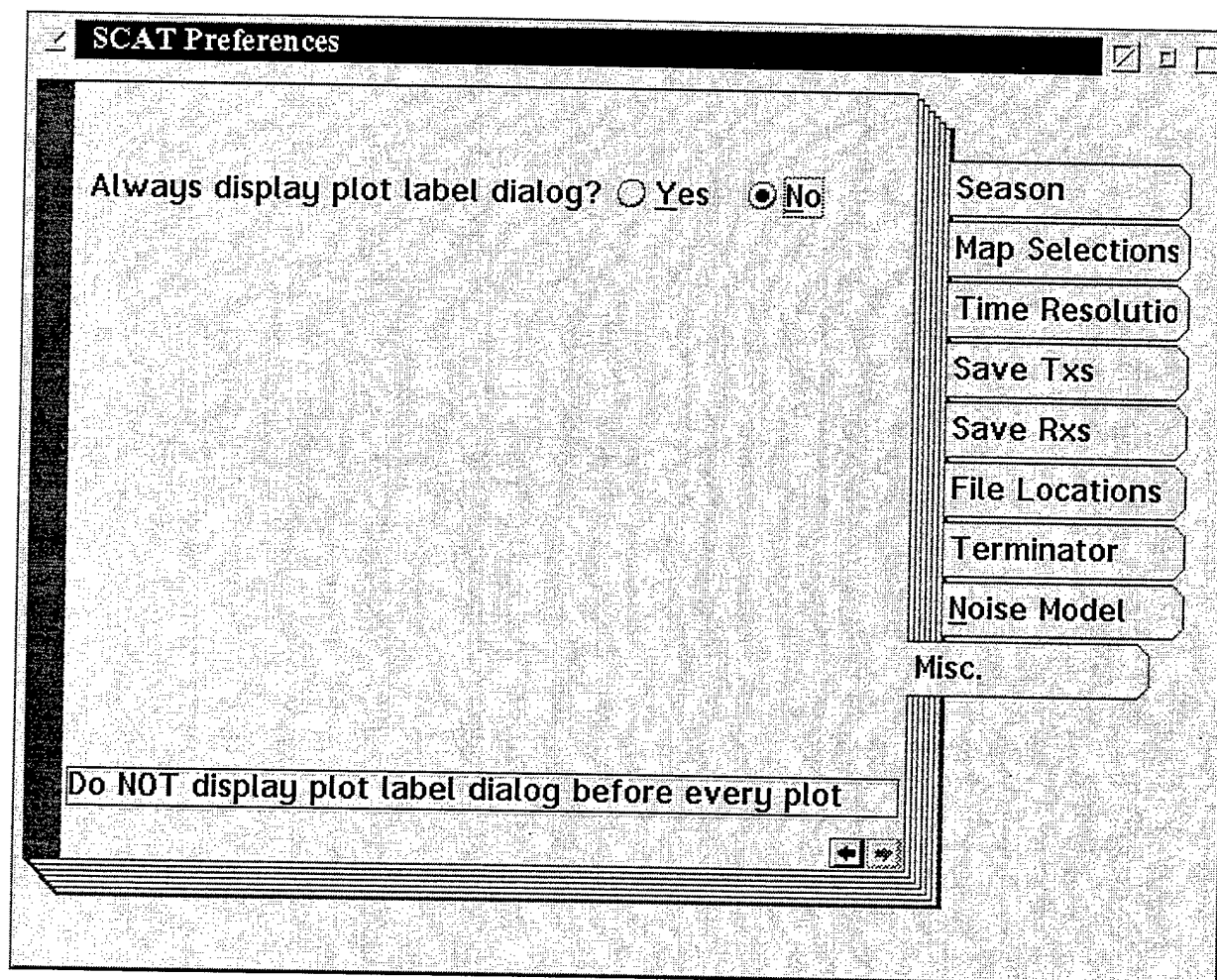


Figure 34. Miscellaneous SCAT Preferences.

SECTION 10

NOTES

10.1 TECHNICAL ASSISTANCE

Technical assistance can be provided by the following points of contact:

<u>Name</u>	<u>FAX Number</u>	<u>Phone Number</u>
Tom Hepner, Software Developer	619-553-3058	619-553-3071
Jerry Ferguson, Program Manager	619-553-3058	619-553-3056

10.2 DISTRIBUTION

The SCAT program and its associated documentation are available to the U.S. Government and U.S. Government contractors only. Configuration management copies and new versions are available through the Naval Command, Control and Ocean Surveillance Center (NCCOSC) Research, Development, Test and Evaluation Division (NRaD) Code D882.

10.3 SCAT LIMITATIONS

There are no known limitations within the SCAT program.

10.4 GLOSSARY

This subsection defines acronyms and abbreviations used within this document.

CPIP	Coverage Prediction Improvement Program
CPU	Central Processing Unit
CSCI	Computer Software Configuration Item
dB	Decibel
FDB	Fixed VLF/LF Data Base
FPMC	FVLF Power Management Capability
FSK	Frequency Shift Keying
FVLF	Fixed Very Low Frequency
GUI	Graphical User Interface
kHz	Kilohertz
kW	Kilowatt
LF	Low Frequency
MB	Megabyte
MSK	Minimum Shift Keying
NCCOSC	Naval Command, Control and Ocean Surveillance Center
OS/2	Operating System / 2
PM	Presentation Manager
RAM	Random Access Memory
RDTE	Research, Development, Test and Evaluation
SCAT	Submarine Communications Assessment Tool
SNR	Signal-to-Noise Ratio
SV	Software Version
SVGA	Super Video Graphics Array
UG	User's Guide
VDD	Version Description Document
VGA	Video Graphics Array
VLF	Very Low Frequency

REPORT DOCUMENTATION PAGE

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